No 182 (182) (2026)

The scientific heritage
(Budapest, Hungary)
The journal is registered and published in Hungary.
The journal publishes scientific studies, reports and reports about achievements in different scientific fields.
Journal is published in English, Hungarian, Polish, Russian, Ukrainian, German and French.
Articles are accepted each month.
Frequency: 24 issues per year.
Format - A4
ISSN 9215 — 0365

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ECONOMIC SCIENCES

ECONOMIC MECHANISMS AND STRATEGIC TRENDS IN THE DEVELOPMENT OF THE AGRICULTURAL SECTOR OF AZERBAIJAN UNDER TECHNOLOGICAL TRANSFORMATION

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Abstract

The agricultural sector of Azerbaijan occupies a key position in the national economy, determining the level of food security, the sustainability of regional development, and export dynamics. In the context of technological transformation and the modernization of production processes, there is an increasing need to assess the factors influencing the competitiveness of agriculture.

The purpose of this study is to identify the economic mechanisms and strategic trends in the development of the agricultural sector of Azerbaijan, based on a comprehensive assessment of statistical data, institutional changes, and technological innovations.

The study employs methods of economic-statistical analysis, structural-logical modeling, and comparative research. The analysis is based on data from the State Statistical Committee of Azerbaijan for the period 2010–2024.

The results show that the sector's dynamics are driven by investments in fixed capital, modernization of irrigation infrastructure, digitalization of management processes, and expansion of export potential. At the same time, several constraints have been identified, including uneven regional development, low levels of mechanization in small farms, insufficient logistics infrastructure, and increasing climate risks.

The findings make it possible to formulate practical recommendations aimed at improving the efficiency of state regulation, developing agricultural clusters, and implementing innovative technologies.

Keywords: agricultural economics; agricultural sector; food security; export; investments; innovations; digitalization; agricultural policy.

2. Introduction

The development of the agricultural sector of Azerbaijan at the present stage is determined by a combination of economic, technological, and institutional factors that shape the sustainability of the food system and ensure long-term growth of the national economy. Agriculture traditionally occupies a significant share in employment and regional development; however, global changes—including climate challenges, shifts in demand, intensification of international competition, and the need for infrastructure modernization—require a reconsideration of strategic approaches to sector management.

In recent years, the government has undertaken a number of measures aimed at supporting agriculture, including the introduction of new types of subsidies, the development of agro-parks and clusters, the digitalization of services, the modernization of irrigation systems, and the expansion of export opportunities. Nevertheless, despite the positive dynamics of certain indicators, a number of problems persist that constrain productivity growth, such as land fragmentation, low levels of mechanization in small farms, regional disparities, and limited logistics and processing infrastructure.

A review of the scientific literature indicates that issues related to improving the efficiency of agricultural production, enhancing state support mechanisms, and implementing innovations remain among the most

relevant both in global research and in the works of domestic scholars. However, a comprehensive assessment of economic mechanisms and long-term development trends of Azerbaijan's agricultural sector under conditions of technological transformation remains insufficiently explored.

In this regard, the purpose of this study is to conduct a comprehensive analysis of the dynamics of the agricultural sector of Azerbaijan, identify the key economic factors of its development, and determine strategic directions for its modernization. To achieve this goal, the following objectives are set: systematization of statistical indicators for 2010–2024; analysis of the influence of investment, technological, and institutional factors; identification of constraints and potential risks; and formulation of practical recommendations aimed at enhancing the competitiveness of the agricultural sector.

3. Methods

The methodological framework of this study was developed with consideration of the need for a comprehensive analysis of economic processes occurring in the agricultural sector of Azerbaijan. The research employs methods that integrate macroeconomic assessment, statistical observation, and structural analysis of sectoral development. The combination of these approaches ensures the reliability of the results and their practical applicability.

First, the economic-statistical method was applied to analyze the dynamics of key agricultural indicators over the period 2010–2024. The data were obtained from official sources, including the State Statistical Committee of Azerbaijan, as well as materials from the FAO, the World Bank, and specialized analytical reports. Statistical indicators were aggregated, normalized, and compared across years, allowing for the identification of long-term trends.

Second, a comparative analysis method was used to assess the development trends of Azerbaijan's agricultural sector in relation to global and regional processes. The comparison was conducted across several dimensions, including productivity, export activity, investment levels, the structure of crop and livestock production, and the level of technological advancement.

Third, structural-logical analysis was employed to identify relationships between institutional reforms, investment flows, infrastructure modernization, and changes in the sectoral structure. This method made it possible to determine the strengths and weaknesses of the existing development model of the agricultural sector.

Fourth, time-series analysis was incorporated to develop forecast assessments based on trends observed in recent years. For interpreting temporal dynamics, indicators such as gross agricultural output, crop yields, exports, and investment activity were examined.

In addition, a qualitative analysis of scientific publications by domestic and foreign researchers was conducted. This made it possible to establish the theoretical foundation of the study, identify unresolved issues, and highlight areas requiring further scientific investigation.

The use of a comprehensive methodological approach allows for well-grounded conclusions, identification of systemic relationships, and the development of recommendations oriented toward practical implementation in the public administration of the agricultural sector.

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4. Results and Discussion

4.1. General Dynamics of the Agricultural Sector Development in Azerbaijan (2010–2024)

Over the analyzed period, the agricultural sector of Azerbaijan demonstrates steady positive dynamics, driven by institutional reforms, increased public investment, and expanding export opportunities. Gross agricultural output increased from 4.17 billion manats in 2010 to 7.92 billion manats in 2024, indicating a significant strengthening of the sector.

Table 1

Dynamics of Gross Agricultural Output in Azerbaijan (billion manats)

Year	Total	Crop Production	Livestock Production
2010	4.17	1.84	2.33
2015	5.60	2.45	3.15
2020	6.73	3.02	3.71
2023	7.60	3.45	4.15
2024	7.92	3.63	4.29

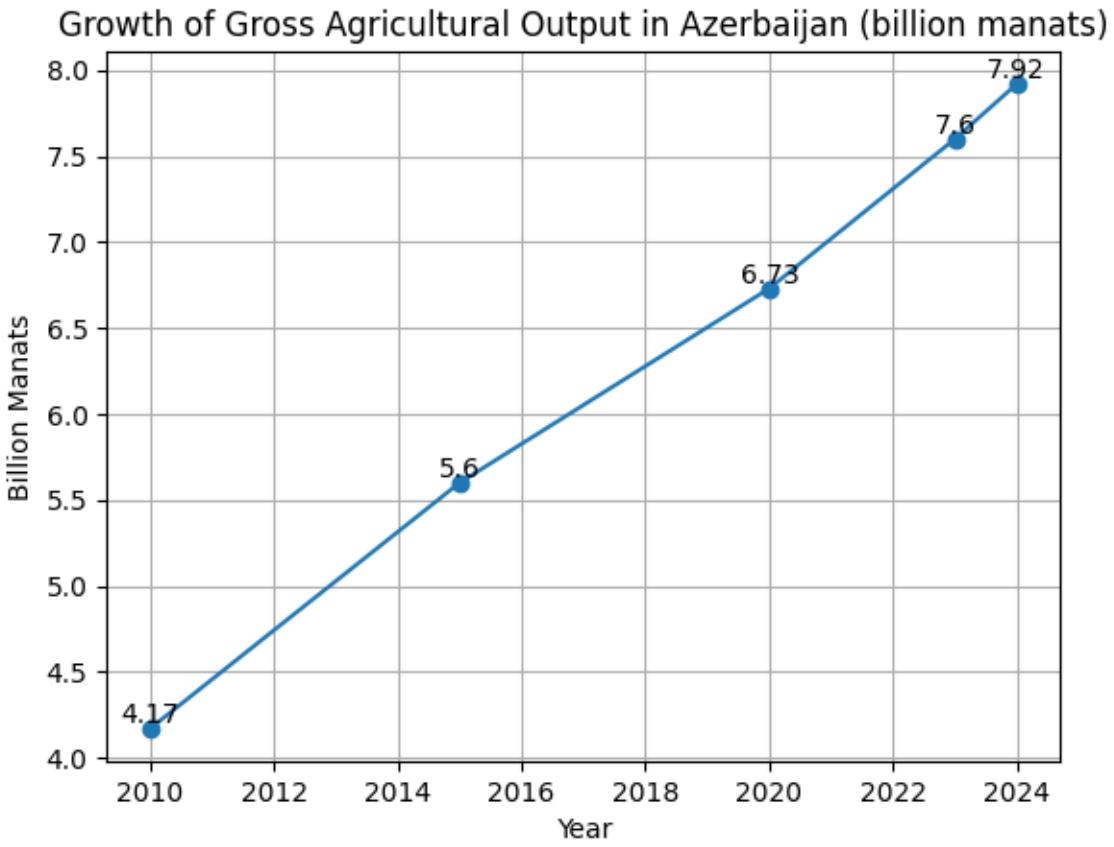

Figure 1 — Growth trend of gross output (descriptive):

The data indicate a balanced expansion of both crop production and livestock farming. However, the fastest growth rates are observed in fruit production and greenhouse farming.

4.2. Structural Changes in Crop Production

Over the past 14 years, significant structural shifts have occurred in Azerbaijan's crop production sector. The most notable growth has been recorded in the production of grains, fruits, vegetables, and industrial crops.

Table 2

Production of Major Agricultural Crops

Year	Grains (thousand tons)	Yield (centners/ha)	Vegetables (thousand tons)	Fruits (thousand tons)
2010	2,150	27	1,330	820
2020	3,350	32	1,870	1,230
2023	3,420	33	1,940	1,310
2024	3,550	34	1,980	1,350

The increase in grain yields is associated with the introduction of new crop varieties, expansion of irrigated land, and the digitalization of irrigation systems. The fruit and vegetable segment shows strong export orientation. Particularly notable growth is observed in the production of pomegranates, grapes, persimmons, and nuts, driven by favorable global market conditions.

4.3. State and Development of Livestock Farming

Livestock farming remains a stable component of Azerbaijan's agricultural sector. Despite moderate growth in livestock numbers, productivity and output volumes are increasing at a faster pace due to farm modernization, improved breeding practices, and a well-developed veterinary system.

Table 3

Livestock Production

Indicator	2010	2020	2024
Milk (thousand tons)	1,800	2,050	2,150
Meat (thousand tons)	290	330	360

Livestock farming is particularly developed in the western and northern regions of the country, where favorable natural conditions support meat and dairy production.

4.4. Export Activity of the Agricultural Sector

Exports represent a key driver of agricultural development in Azerbaijan. Between 2010 and 2024, agricultural exports increased more than 2.5 times, reaching 1.1 billion USD in 2024.

Table 4

Agricultural Exports of Azerbaijan (million USD)

Year	Total	Fruits	Vegetables	Nuts	Cotton
2010	430	180	170	25	22
2020	820	390	290	50	45
2024	1,100	500	330	75	70

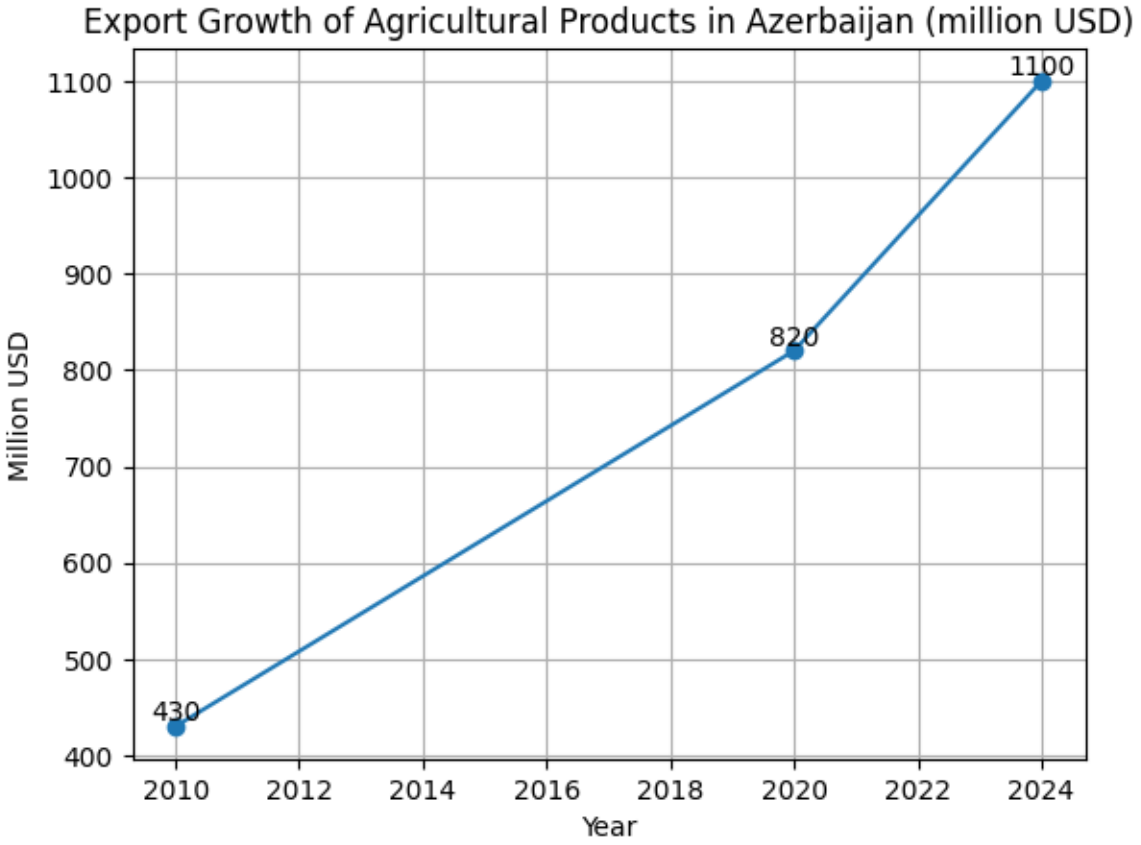

Figure 2 — Export growth trend:)

The most demanded export products include pomegranates, tomatoes, cucumbers, feijoa, hazelnuts, grapes, and cotton fiber.

Export growth has been stimulated by improvements in logistics, construction of cold storage facilities, development of agro-parks, and enhancement of quality standards.

4.5. Investments and Technological Modernization

Investment activity is one of the key drivers of sectoral development. Investments in fixed capital increased from 330 million manats in 2010 to 850 million manats in 2024, ensuring accelerated modernization of agricultural enterprises.

The main investment areas include irrigation system reconstruction, implementation of drip irrigation, acquisition of modern machinery, and digitalization of agro-services.

The productivity formula used in the analysis is as follows:

$$P = Q / L$$

where:
Q — output volume
L — labor input

An increase in labor productivity is observed across almost all subsectors, particularly in greenhouse production and intensive horticulture.

4.6. Institutional and Economic Mechanisms of Agricultural Sector Development

The efficiency of the agricultural sector largely depends on the quality of the institutional environment and the economic regulatory mechanisms applied. In Azerbaijan, a multi-level system of state support for agriculture has been formed in recent years, including direct subsidies, tax incentives, preferential lending, agricultural risk insurance, and institutional support for farmers.

A key element of this system is the transition from universal support measures to targeted and result-oriented mechanisms. In particular, the introduction of an electronic subsidy system has increased transparency in the allocation of budget funds and reduced transaction costs. This approach aligns with the findings of I.M. Kublin, who emphasizes that the digitalization of agricultural policy institutions reduces information asymmetry and contributes to increased production efficiency in transition economies.

The development of agricultural clusters and agro-parks is of particular importance, as they serve as instruments of institutional coordination among producers, processing enterprises, logistics centers, and export structures. Studies by I.M. Kublin (2019; 2021) show that the cluster model not only increases productivity but also accelerates technological modernization through economies of scale and synergy effects.

In Azerbaijan, agro-parks are becoming platforms for the implementation of modern technologies, quality standards, and export practices. At the same time, the problem of institutional fragmentation of small farms persists, limiting their access to investment resources and innovations. This necessitates further development of cooperative forms of farming and strengthening the role of regional agricultural agencies.

4.7. Digital Transformation and the Implementation of Precision Agriculture Technologies

Digital transformation is one of the most promising directions for modernizing the agricultural sector. In recent years, Azerbaijan has actively implemented elements of digital agriculture, including land registries, crop monitoring systems, automated irrigation control, and satellite-based observation of crop conditions.

Estimates show that the use of precision agriculture technologies can increase crop yields by 10–20% while reducing the consumption of water, fertilizers, and energy. Similar findings are presented in the studies of I.M. Kublin, where digital tools are identified as a key factor in ensuring the sustainability of agricultural production under climate uncertainty.

In Azerbaijan, digitalization is most активно developed in greenhouse farming, intensive horticulture, and export-oriented crop production. The use of soil moisture sensors, automated drip irrigation systems, and digital farm management platforms enhances process control and reduces production losses.

However, the level of digital maturity in the agricultural sector remains uneven. Small and medium-sized farms face limited access to digital technologies due to financial constraints and insufficient digital literacy. This confirms Kublin's conclusion on the need for institutional support for digital transformation through educational programs and subsidies for innovative solutions.

4.8. Climate Risks and Sustainability of Agricultural Production

Climate change is exerting an increasing impact on Azerbaijan's agricultural sector, manifesting in temperature fluctuations, more frequent droughts, and reduced water availability. These factors increase the risks of production instability and require adaptation of existing land-use models.

The analysis shows that regions heavily dependent on irrigated agriculture are the most vulnerable. In this context, modernization of irrigation infrastructure and the introduction of water-saving technologies become strategic priorities. Research by I.M. Kublin emphasizes that the sustainability of agricultural systems is directly linked to institutional capacity to adapt to climate shocks.

In Azerbaijan, projects are being implemented to reconstruct irrigation canals, introduce automated water resource management systems, and expand the use of drip irrigation. These measures help reduce climate risks and increase the adaptive capacity of the sector.

4.9. Scenario Forecasts for the Development of the Agricultural Sector up to 2030

Based on the analysis of data for 2010–2024 and identified trends, a scenario-based forecast for the development of Azerbaijan's agricultural sector up to 2030 has been developed. Three scenarios are considered: inertial, innovative, and adaptive-sustainable.

The inertial scenario assumes the preservation of current growth rates without significant expansion of investment and digitalization. In this case, gross output growth will be limited to 2–3% annually.

The innovative scenario is based on the active implementation of digital technologies, expansion of agricultural clusters, and increased export orientation. This scenario allows for growth rates of 4–5% per year.

The adaptive-sustainable scenario takes into account climate risks and focuses on sustainable resource management. This scenario corresponds to Kublin's conclusions regarding the priority of institutional sustainability and ensures balanced growth with minimized risks.

5. Discussion

The obtained results confirm that the development of the agricultural sector of Azerbaijan under conditions of technological transformation is systemic in nature and determined by a combination of institutional, investment, and technological factors. In contrast to earlier stages of agrarian reforms, which were primarily focused on increasing production volumes, the current stage is characterized by a shift toward efficiency, sustainability, and export competitiveness.

A comparison of the empirical findings with previous scientific studies demonstrates a high degree of consistency. In particular, the works of I.M. Kublin (2018; 2020; 2022) emphasize that for transition economies, the key driver of agricultural growth is not merely the expansion of resource capacity, but rather institutional coordination and the implementation of digital management tools. Similar trends are observed in Azerbaijan, where the digitalization of subsidies, the development of agro-parks, and the modernization of irrigation systems contribute to cost reduction and productivity growth.

The results related to export orientation are of particular importance. Unlike a number of post-Soviet countries where agricultural exports remain largely raw-material-based, Azerbaijan demonstrates a gradual transition toward exports with higher added value. This finding corresponds with Kublin's research, which highlights the importance of processing and logistics development for integration into global value chains.

At the same time, the identified constraints—climate risks, regional disparities, and fragmentation of small farms—confirm the conclusions of international studies that technological modernization alone, without institutional support, cannot ensure long-term sustainability. The works of I.M. Kublin stress that sustainable agricultural development requires a combination of digital innovation with reforms in land use, cooperation, and agricultural education. The results of this study confirm this hypothesis in the context of Azerbaijan.

The scientific novelty of the study lies in the integrated assessment of economic mechanisms and strategic development trends of the agricultural sector of Azerbaijan under technological transformation, taking into account institutional and climate factors. Unlike existing studies, this paper proposes a scenario-based approach to evaluating development prospects, allowing consideration of both investment and adaptive dimensions.

6. Conclusion

The conducted research leads to the conclusion that the agricultural sector of Azerbaijan in 2010–2024 developed along a trajectory of sustainable growth, driven by institutional reforms, increased investment activity, and gradual technological modernization. The growth of gross output, expansion of export potential, and increase in labor productivity indicate the formation of a new model of agricultural development focused on efficiency and competitiveness.

At the same time, the results show that further development of the sector faces a number of systemic challenges, including increasing climate risks, regional imbalances, and limited access of small farms to innovations. These factors necessitate adjustments in current agricultural policy and strengthening of institutional support mechanisms.

The practical significance of the study lies in the possibility of applying its findings in the development of agricultural strategies, digitalization programs, and support mechanisms for export-oriented production. The results may also be used in further research on sustainable development and technological transformation of agricultural economies.

Future research directions include a deeper analysis of the effectiveness of specific state support instruments, assessment of the socio-economic effects of agricultural digitalization, and comparative studies of agricultural models in the South Caucasus region.

7. Limitations and Future Research Directions

Despite the obtained results, the study has several limitations. First, the analysis is primarily based on aggregated statistical data, which limits the ability to assess microeconomic effects at the level of individual farms. Second, the impact of climate factors was assessed indirectly, without the use of specialized climate models.

In future research, it is advisable to expand the empirical base by incorporating farm-level microdata, as well as integrating climate and econometric models for a more accurate assessment of the sustainability of the agricultural sector.

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A STAKEHOLDER-ORIENTED STRATEGY FOR ENHANCING THE INVESTMENT ATTRACTIVENESS OF CONSTRUCTION COMPANIES: DIRECTIONS FOR DEVELOPMENT AND IMPLEMENTATION

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Abstract

It has been demonstrated that the investment attractiveness of construction companies underpins the formulation and implementation of modern development strategies. It serves as an indicator of the capabilities and dynamism of construction companies, as well as the level of interaction with domestic and international investors.

Stakeholders influence the processes of ensuring investment attractiveness. They are characterised as groups of interested parties interacting within the system of production and economic activities of construction enterprises and are characterised by the influence of socio-economic, financial, investment, urban planning, spatial, environmental and security factors, the actions of which are aimed at shaping and implementing the development directions of companies, ensuring their investment attractiveness.

It has been established that a pressing issue is the identification of directions for the development and implementation of a stakeholder-oriented strategy for shaping the investment attractiveness of construction enterprises.

The development and implementation of a stakeholder-oriented strategy for building the investment attractiveness of construction enterprises involves the following stages: establishing an information and analytical system to support a stakeholder-oriented strategy for building investment attractiveness; the development and implementation of a theoretical and methodological approach to assessing the level of investment attractiveness of construction enterprises; the implementation of economic and mathematical modelling of factors influencing the investment attractiveness of construction enterprises; forecasting changes in the integrated indicator of the level of investment attractiveness of construction enterprises; identifying growth sectors; characterisation and assessment of the extent to which the external and internal environment influences the implementation of a stakeholder-oriented strategy for building investment attractiveness; development of a roadmap for implementing the stakeholder-oriented strategy; creation of scenarios for building the investment attractiveness of construction enterprises; development and implementation of scientifically grounded recommendations for increasing the level of investment attractiveness of construction enterprises, taking into account the influence of stakeholders; establishment of an organisational and economic mechanism for building the investment attractiveness of construction enterprises.

Keywords: investment attractiveness, construction companies, stakeholder-oriented strategy, scenarios.

Introduction. The investment attractiveness (IA) of construction enterprises (CE) underpins the formulation and implementation of their current development strategies. It serves as an indicator of the capabilities and activity of construction enterprises, as well as the level of interaction with domestic and international investors.

The investment attractiveness of construction enterprises is characterised as an integrated indicator determined by financial, economic, environmental and urban planning factors, the interaction between which is viewed through the prism of investment activity and the relationships between foreign and domestic investors, developers, clients of construction products, design organisations, and other stakeholders to enhance the effectiveness of investment activities.

Stakeholders influence the processes of ensuring investment attractiveness. They are characterised as groups of interested parties interacting within the system of production and economic activities of construction enterprises and are characterised by the influence of socio-economic, financial, investment, urban planning, spatial, environmental and security factors, the effects of which are aimed at shaping and implementing the development directions of companies, ensuring their investment attractiveness.

In the current extraordinary conditions, influenced by the consequences of aggressive military operations,

a pressing issue is the development and implementation of a strategy as a comprehensive category that creates conditions for the development of construction enterprises.

A stakeholder-oriented strategy for building the investment attractiveness of construction enterprises is based on a theoretical, methodological and regulatory framework and is defined by a system of interrelated actions characterised by the influence of socio-economic, spatial, urban planning, security, investment, environmental and stakeholder factors, aimed at enhancing the effectiveness of investment attractiveness formation to ensure the development of construction enterprises.

At the same time, the question of identifying the key areas for the development and implementation of a stakeholder-oriented strategy to enhance the investment attractiveness of construction companies remains a pressing issue.

Justification of existing theoretical approaches. It has been established that the consequences of Russian aggression influence the operations of construction companies, as well as the development and implementation of a stakeholder-oriented strategy for enhancing investment attractiveness. This necessitates a rethinking of approaches to the implementation of this strategy and ensuring effective stakeholder engagement. Furthermore, the processes described are exacerbated by the transformational processes taking place in the construction sector. In particular, the following areas are decisive: technical support for construction and the complexity of its implementation; the long-term nature of construction production; organisational features of the operation of construction enterprises; the definition and directions for building the investment attractiveness of construction enterprises; and managerial aspects of stakeholder interaction. In this context, the following developments should be noted [1, 2].

In the current climate, the following measures are proposed to ensure the stable operation of construction companies: improving safety standards; resuming operations of construction companies by ensuring a reliable supply of electricity and building materials; introducing and implementing housing reconstruction programmes at national and regional levels; and ensuring transparency in the implementation of the country's reconstruction programmes [3].

It should be noted that stakeholders influence the development and maintenance of investment attractiveness. They are defined as individuals or groups of individuals with an interest in any decisions or activities relating to the implementation of a project [4]. In line with the principles of this approach, stakeholders are defined as individuals, groups or organisations that may influence, be influenced by, or perceive themselves as being affected by a decision, action or outcome of the project [5].

The following key stakeholder groups have been identified: consumers and customers; suppliers; local authorities; tax and other regulatory bodies; shareholders, investors and owners; the community and civil society organisations; employees and their representative bodies; the media; credit rating agencies; financial institutions; and government bodies [6].

Applying a functional approach, the procedural aspects of stakeholder analysis are outlined as follows:

– preparatory stage (selection of experts for stakeholder analysis; selection of stakeholder analysis tools; development of the scale to be used during the analysis);

– analytical stage (identification and grouping of stakeholders (Stakeholder's Map); prioritisation of stakeholder groups based on the strength of their influence on the enterprise's activities using an analytical method; construction of a stakeholder group interests matrix based on a semantic analysis of the 'interests–threats' chain; identification of stakeholders using the 'power/interest' matrix; prioritisation of stakeholder groups' interests; construction of an interest balance matrix and calculation of the overall level of interest balance);

– strategic and managerial stage (identification of possible strategies for each stakeholder group; selection of an interaction strategy);

– monitoring stage (monitoring changes in stakeholders; monitoring changes in stakeholders' interests and influence; monitoring changes in the priorities of stakeholder groups; monitoring the interaction strategy) [6–8].

The proposed areas for developing a stakeholder-oriented approach to ensuring the development of construction companies:

– establishing an information and analytical framework regarding the interaction between stakeholders of construction companies and factors influencing their development;

– identification of stakeholder factors influencing the development of construction enterprises;

– development of a multi-level system of indicators;

– assessment of local stakeholder indicators using analytical and expert methods;

– developing models for assessing summary stakeholder indicators;

– assessing summary stakeholder indicators for construction companies;

– developing an integrated model for assessing the stakeholder indicator of construction companies' development;

– assessing the integrated indicator;

– interpreting the results obtained [9].

At the same time, questions remain unresolved regarding the identification of directions for the development and implementation of a stakeholder-oriented strategy for enhancing the investment attractiveness of construction companies.

The aim of the study is to identify directions for the development and implementation of a stakeholder-oriented strategy for enhancing the investment attractiveness of construction companies.

Main section. The development and implementation of a stakeholder-oriented strategy for enhancing the investment attractiveness of construction enterprises involves the following stages:

1. Establishment of an information and analytical system to support a stakeholder-oriented strategy

for enhancing the investment attractiveness of construction enterprises.

2. Development and implementation of a theoretical and methodological approach to assessing the level of investment attractiveness of construction enterprises.

3. Conducting economic and mathematical modelling of factors influencing the investment attractiveness of construction enterprises.

4. Forecasting changes in the integrated indicator of the level of investment attractiveness of construction enterprises.

5. Identification of sectors for growth in the level of investment attractiveness of construction enterprises.

6. Characterisation and assessment of the extent to which the external and internal environment influences the implementation of a stakeholder-oriented strategy for building the investment attractiveness of construction enterprises.

7. Development of a roadmap for the implementation of a stakeholder-oriented strategy.

8. Creation of scenarios for the development of investment attractiveness of construction enterprises.

9. Development and implementation of scientifically grounded recommendations for increasing the level of investment attractiveness of construction enterprises, taking into account the influence of stakeholders.

10. Establishment of an organisational and economic mechanism for building the investment attractiveness of construction enterprises.

The development of an information and analytical system to support a stakeholder-oriented strategy for building the investment attractiveness of construction enterprises is based on the results of analytical and expert assessments of the relevant local factors.

The development and implementation of a theoretical and methodological approach to assessing the level of investment attractiveness of construction enterprises has made it possible to determine an integrated indicator and form an important element of the quantitative basis for creating a stakeholder-oriented strategy.

In developing the presented strategy, the results of economic and mathematical modelling of construction enterprises' investment attractiveness factors are applied as the second element of the quantitative basis.

Forecasting changes in the integrated indicator of the level of development of construction enterprises' investment attractiveness has made it possible to identify sectors of growth in the level of development of construction enterprises' investment attractiveness. This is the third element of the quantitative basis for a stakeholder-oriented strategy. The characterisation and assessment of the extent to which the external and internal environments influence the implementation of a stakeholder-oriented strategy for building the investment attractiveness of construction enterprises is carried out using SWOT analysis, the importance of which is emphasised in [10, 11].

As part of the development and implementation of a stakeholder-oriented strategy, the following scenarios for enhancing the investment attractiveness of construction companies have been proposed:

– ***pessimistic***: characterised by a permanent decline in the index of investment attractiveness of construction enterprises, a reduction in the effectiveness of stakeholder interaction in the field of investment activity, a deepening of the slowdown in the development of construction enterprises, a decline in production capacity, the level of working capital utilisation, operational efficiency, liquidity, and the use of equity and debt capital; problematic issues accumulate in the security, environmental, investment and innovation sectors, as well as in overcoming the consequences of Russian aggression; and issues regarding ensuring the effective functioning of the construction sector remain unresolved. The level of provision and implementation of monitoring procedures declines. It should be noted that the index of investment attractiveness ranges from 0 to 4;

– ***stabilisation***: characterised by mixed trends in the investment attractiveness index of construction enterprises, where periods of growth alternate with decline and vice versa; the level of stakeholder interaction in investment activities is stabilising, trends in the development of construction enterprises are evident, there is an unsystematic strengthening of production capacity, an increase in the utilisation of working capital, operational efficiency, liquidity provision, and the use of equity and borrowed capital; the security, environmental, investment and innovation situation is stabilising despite the impact of the Russian Federation's aggression; and there are isolated positive developments in the construction sector. Monitoring procedures are implemented in a non-systematic manner. The investment attractiveness index ranges from 4.01 to 6;

– ***transitional***: non-systematic trends in the growth of the investment attractiveness index for construction enterprises are identified; the level of stakeholder interaction in the field of investment activity is increasing; trends in the development of construction enterprises in specific areas are observed; production capacity and working capital are being strengthened; profitability and liquidity are increasing; the level of utilisation of equity and borrowed capital is increasing; the scope for applying security, economic, investment and innovation instruments is being strengthened despite the impact of the Russian Federation's aggression; positive developments are taking place in the construction sector. A monitoring mechanism has been established for the formation and use of investment resources. The index of investment attractiveness formation ranges from 6.01 to 8;

– ***development***: systemic trends in the growth of the investment attractiveness index for construction enterprises have been identified; the level of stakeholder interaction in the field of investment activity is increasing; trends in the development of business processes are observed; production capacity and working capital are being strengthened; profitability and liquidity are increasing; the level of utilisation of equity and borrowed capital is increasing; the application of security, economic, investment and innovation tools is consistently ensured despite the impact of the Russian Federation's

aggression; and the construction sector is developing. There is ongoing monitoring of the formation and use of investment resources. The investment attractiveness index ranges from 8.01 to 10.

Conclusions. Thus, the conceptual framework for defining a stakeholder-oriented strategy for enhancing the investment attractiveness of construction enterprises has been refined. This strategy is based on theoretical approaches that characterise the types and levels of interaction among stakeholders, the specific features of ensuring the investment attractiveness of construction enterprises, and includes a system of interrelated actions that takes into account the influence of socio-economic, spatial, urban planning, security, investment, environmental and stakeholder factors. This makes it possible to establish a strategic framework for increasing the investment attractiveness of construction enterprises.

Approaches to the development and application of strategic tools have been further refined; these are defined by the proposed roadmap and the results of the SWOT analysis, which provide the means to establish an informational and functional foundation for the creation and implementation of a stakeholder-oriented strategy for enhancing the investment attractiveness of construction enterprises.

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JURIDICAL SCIENCES

THE CRIMINAL JUSTICE SYSTEM OF GEORGIA: STRUCTURE, SENTENCING, AND REFORM

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DOI: 10.5281/zenodo.19491256

Abstract

This article presents an expanded analysis of Georgia's criminal justice system, based on thesis research and official references. It examines the constitutional framework, institutional arrangements, sentencing practices, crime trends, penitentiary and probation systems, and the trajectory of reforms undertaken since the mid-2000s. Official legislation, international reports, and state data are used throughout. By reorganizing and elaborating upon the thesis text, the article seeks to provide a comprehensive overview suitable for academic discussion, with particular attention to reform dynamics, challenges of rehabilitation, and the balance between custodial and non-custodial sanctions.

Keywords: Georgia; criminal justice system; courts; sentencing; penitentiary; probation; parole; plea bargaining; jury trial; reform; rehabilitation.

Introduction

The evolution of Georgia's criminal justice system reflects broader democratic consolidation efforts in the post-Soviet period. The 1995 Constitution laid the foundation for judicial independence and the rule of law (Constitution of Georgia, 1995, Article 83(1)). However, systemic challenges such as prison overcrowding, limited alternatives to custody, and high recidivism persisted. Since 2006, successive reforms have aimed at addressing these issues through new legislation, institutional restructuring, and collaboration with international partners (Criminal Justice Reform Strategy, 2013). This article provides a comprehensive, citation-integrated discussion of these developments, drawing on official data, reports, and legal acts.

1. Constitutional and Judicial Framework

The judiciary occupies a central role in Georgia's criminal justice system, being both the guarantor of constitutional order and the final arbiter in disputes concerning individual rights. The 1995 Constitution, adopted after the restoration of independence, firmly established that justice shall be administered solely by the courts, thereby eliminating the legacy of Soviet-era quasi-judicial bodies and parallel adjudication mechanisms (Constitution of Georgia, 1995, Article 83(1)). This principle, reiterated in subsequent legislation, has shaped the normative basis for judicial authority and independence.

Judges must satisfy strict professional criteria: Georgian citizenship, high legal education, and at least five years of professional practice (Constitution of Georgia, 1995, Article 86(1–2); Organic Law on General Courts, 2009, Article 2(1)). The Organic Law on General Courts sets out a three-tier hierarchy: city and district courts at the first instance, regional appellate courts (in Tbilisi, Kutaisi, and Batumi), and the Supreme Court as the highest judicial authority for general cases. Alongside this structure, the Constitutional Court—established in 1996—exercises the crucial power of constitutional review, including the annulment of unconstitutional laws and acts (Constitution of Georgia, 1995, Article 64(1–2)). Its creation signaled Georgia's commitment to aligning with European models of constitutional adjudication.

A cornerstone of judicial governance is the High Council of Justice (HCJ), the body entrusted with appointments, promotions, disciplinary proceedings, and the administration of courts. According to the Organic Law on General Courts, the HCJ consists of 15 members: a majority elected by the Conference of Judges, representatives appointed by the President and Parliament, and the Chairperson of the Supreme Court who serves ex officio as its head (Organic Law on General Courts, 2009, Article 49(1)). The model combines judicial self-governance with external oversight, intended to insulate the judiciary from political manipulation while retaining some measure of democratic accountability.

Despite this constitutional architecture, the judiciary's practical independence has been a persistent concern throughout the post-Soviet era. In the 1990s, judicial institutions struggled with weak capacity, underfunding, and the remnants of Soviet legal culture. The early 2000s saw intensified reform efforts, but also growing public distrust of the courts, often perceived as politicized and lacking impartiality. After the 2003 Rose Revolution, reforms accelerated: large-scale judicial appointments were carried out, salaries increased to reduce corruption, and international organizations supported training and modernization. However, observers, including the Public Defender of Georgia, Amnesty International, and the Council of Europe, repeatedly emphasized that formal guarantees of independence were undermined by political influence over key decisions, particularly appointments and dismissals (Public Defender of Georgia, 2013; CPT, 2012; Amnesty International, 2012).

The judiciary's evolution since independence thus reflects both progress and persistent challenges. On the one hand, Georgia successfully established the institutional foundations of a constitutional judiciary in line with European standards. On the other, entrenched practices of political interference and limited transparency in judicial governance continue to undermine pub-

lic confidence. Ensuring genuine independence, impartial adjudication, and merit-based career advancement for judges remains a central challenge for the consolidation of the rule of law.

2. Reform Trajectory

The trajectory of criminal justice reform in Georgia reflects the broader political and social transformations of the country since independence. In the immediate post-Soviet period of the 1990s, the justice system was characterized by instability, lack of resources, and widespread corruption. Courts struggled to assert authority, and public trust in the judiciary remained extremely low. This period also saw the persistence of Soviet legal traditions, including heavy reliance on custodial sanctions and limited procedural guarantees for defendants.

A turning point came after the 2003 Rose Revolution, when the newly elected government initiated sweeping institutional reforms aimed at strengthening state authority and combating systemic corruption. Within the justice sector, these reforms took shape in a "zero tolerance" approach to crime, declared by President Mikheil Saakashvili in 2006 during the Judges' Oath Taking Ceremony (Saakashvili, 2006). The policy translated into harsher sentencing practices, extensive use of pre-trial detention, and a dramatic expansion of the prison population. By the end of 2011, Georgia had one of the highest incarceration rates in Europe, with 547 prisoners per 100,000 inhabitants (World Prison Population List, 2016).

International criticism soon followed. Amnesty International (2012), Human Rights Watch (2006), and the Committee for the Prevention of Torture (2012) issued reports highlighting prison overcrowding, allegations of torture and ill-treatment, and lack of effective oversight mechanisms. Domestically, the Public Defender of Georgia repeatedly raised concerns about systemic violations of human rights within the penitentiary system (Public Defender of Georgia, 2013). These critiques underscored the tension between the government's emphasis on law and order and its obligations under international human rights standards.

The 2012 parliamentary elections marked a decisive shift. The new government announced a departure from punitive policies and prioritized liberalization of sanctions, rehabilitation of offenders, and reduction of prison overcrowding. The large-scale amnesty of 2012–2013, which led to the release of thousands of prisoners, together with expanded parole and presidential pardons, dramatically reduced the prison population (Supreme Court of Georgia, 2013). While this policy alleviated overcrowding, it also sparked debates about public safety, recidivism, and the preparedness of probation services to handle the influx of released offenders.

Institutional reforms also redefined the architecture of the justice system. The Ministry of Corrections, established in 2008 to administer prisons and probation (Law on Government Structure, 2008a), was merged back into the Ministry of Justice in 2018 (Law on Government Structure, 2018). At the same time, the Office of the Prosecutor General was removed from ministerial subordination and made accountable to Parliament, a change intended to strengthen prosecutorial independence (Constitution of Georgia, 1995, Article 65). These institutional realignments sought to eliminate conflicts of interest and increase transparency, though their effectiveness remains subject to ongoing debate.

A cornerstone of reform planning has been the Criminal Justice Reform Strategy of Georgia (2013), adopted during the 10th session of the Inter-Agency Council. The Strategy set forth objectives including sanction liberalization, juvenile justice reform, increased access to legal aid, judicial independence, improved prison healthcare, and evidence-based policy making (Criminal Justice Reform Strategy, 2013). An accompanying Action Plan (2014) outlined specific activities, timelines, and responsible agencies, linking success indicators to measurable goals such as reductions in re-offending and improvements in public trust. Importantly, the Strategy was developed in consultation with international partners, including the Council of Europe and the European Union, reflecting Georgia's ambition to align its justice policies with European standards.

Overall, Georgia's reform trajectory demonstrates both significant progress and enduring challenges. While the harsh punitive policies of the mid-2000s have been replaced by a more balanced approach emphasizing rehabilitation and alternatives to custody, problems of implementation persist. Limited resources, uneven institutional capacity, and lingering political influence over the judiciary complicate the full realization of reform goals. The future of Georgia's justice system depends on consolidating these reforms, institutionalizing transparency, and ensuring that legal guarantees translate into meaningful protection of rights in practice.

3. Criminal Procedure Innovations

One of the most significant reforms in Georgia's criminal justice system came with the adoption of the new Criminal Procedure Code in 2009, which introduced structural innovations designed to increase fairness, transparency, and public trust. Two central mechanisms—jury trials and plea bargaining—were intended to modernize procedure and bring Georgia closer to European and international standards.

Jury Trials.

The 2009 Code formally introduced jury trials into Georgian criminal justice for the first time (Criminal Procedure Code, 2009, Article 211). The system was initially applied on a limited territorial and subject-matter basis, restricted to selected city and district courts, including Tbilisi, Kutaisi, Batumi, Rustavi, Zugdidi, Telavi, and Gori. The choice to pilot jury trials reflected a cautious approach, recognizing both the symbolic and practical challenges of introducing lay participation into a legal culture that had previously been dominated by professional judges.

Jury trials were heralded as a democratizing step, offering citizens a direct role in the administration of justice. Supporters argued that jurors could act as a counterweight to potential political pressure on judges, enhancing the independence of verdicts. However, critics highlighted several challenges: limited public awareness of jurors' responsibilities, the risk of manipulation during jury selection, and the narrow scope of cases eligible for jury trial. International observers also

noted that while the reform carried important symbolic weight, its restricted application limited its systemic impact.

Plea Bargaining.

Another major innovation was the formalization of plea bargaining, which allowed defendants to agree to plead guilty in exchange for reduced sentences (Criminal Code of Georgia, 1999, Article 55(1a)). Plea agreements were designed to streamline proceedings, reduce judicial backlogs, and encourage cooperation with prosecutors. In practice, plea bargaining quickly became a dominant feature of criminal justice in Georgia, with a large share of cases resolved through negotiated agreements rather than full trials.

This efficiency, however, came at a cost. Critics, including the Public Defender of Georgia, expressed concern that plea bargaining often occurred in an environment of unequal power between prosecutors and defendants (Public Defender of Georgia, 2013). Defendants, especially those without access to adequate legal aid, could feel pressured to accept agreements even in cases where a trial might have led to acquittal. In some instances, the heavy reliance on plea agreements raised questions about the presumption of innocence and the extent to which confessions were genuinely voluntary.

Impact and Critical Debates.

The introduction of jury trials and plea bargaining marked a deliberate shift toward Western-style criminal procedure, but both reforms generated debates about fairness and effectiveness. Jury trials, though promising in principle, remained peripheral due to their limited application. Plea bargaining, while efficient, risked undermining procedural rights if not accompanied by strong safeguards, transparency, and effective defense counsel.

These debates highlight a broader challenge of Georgian criminal justice reform: the balance between efficiency and rights protection. On the one hand, reforms sought to reduce delays and improve public trust by modernizing procedure. On the other, they risked reproducing inequities if not properly implemented. Thus, the real test of these innovations lies not only in their legal adoption but in their consistent, transparent, and fair application in practice.

4. Institutional Reconfiguration

Institutional reforms in Georgia's justice system reflect ongoing attempts to balance efficiency, accountability, and independence. Over the last two decades, the architecture of the criminal justice system has undergone several major transformations, particularly regarding the Ministry of Corrections, the Ministry of Justice, the Office of the Prosecutor General, and the Legal Aid Service.

Creation of the Ministry of Corrections.

In 2008, the government established a separate Ministry of Corrections and Legal Assistance to oversee penitentiary institutions and probation services (Law on Government Structure, 2008a). The rationale was to separate the management of prisons and probation from the Ministry of Justice, where they had previously been subordinated, thereby avoiding potential conflicts of interest between prosecutorial and correctional functions. This reform was part of a broader effort to professionalize prison management and to respond to mounting criticism of prison conditions from international actors such as the Committee for the Prevention of Torture (CPT, 2012) and Human Rights Watch (2006).

Evolution of the Ministry's Mandate.

The Ministry's mandate expanded in subsequent years, incorporating the Penitentiary Department and the Probation Service as legal entities under its authority. In 2007, the Law on Legal Aid also assigned the Ministry the task of managing the Legal Aid Service (Law on Legal Aid, 2007, Article 8(3)). Initially, this arrangement aimed to centralize correctional and legal support services. However, questions quickly arose about whether housing legal aid under the same ministry responsible for prisons and probation compromised its independence.

2013–2018 Adjustments.

Amendments to the Law on Government Structure in 2013 and 2014 fine-tuned the Ministry's competencies (Law on Government Structure, 2013). In 2014, in response to criticism from both domestic civil society and international organizations, the Legal Aid Service was removed from the Ministry's subordination and placed directly under parliamentary supervision. This restructuring aimed to safeguard the independence of free legal assistance and ensure equal access to justice.

2018 Reintegration into the Ministry of Justice.

A major shift occurred in 2018, when the Ministry of Corrections was abolished and reintegrated into the Ministry of Justice (Law on Government Structure, 2018). The reform consolidated penitentiary and probation services under the Ministry of Justice once more. The official justification emphasized efficiency and coordination, arguing that reintegration would streamline justice administration. Yet critics noted the risk of concentrating excessive authority within the Ministry of Justice, potentially reducing oversight and weakening the independence of correctional services.

Prosecutor's Office Reform.

The Office of the Prosecutor General also underwent significant reform. Until 2018, the Office was part of the Ministry of Justice, raising concerns about conflicts of interest. Constitutional amendments adopted in December 2018 formally removed the Prosecutor's Office from ministerial control and placed it under the authority of Parliament (Constitution of Georgia, 1995, Article 65). This realignment was intended to strengthen prosecutorial independence and align Georgia more closely with European standards of separation of powers.

Critical Evaluation.

While these institutional reforms demonstrate responsiveness to both domestic concerns and international recommendations, their effectiveness remains debated. On the one hand, separating corrections from prosecution was an important step toward reducing conflicts of interest. On the other, repeated restructuring has at times created instability, with frequent shifts in mandates undermining continuity and long-term planning. Moreover, despite reforms, the Public Defender and international monitors have continued to report concerns about transparency, independence, and

accountability within both penitentiary and prosecutorial institutions (Public Defender of Georgia, 2013; Amnesty International, 2012).

Thus, the institutional reconfiguration of Georgia's justice system illustrates the complexity of reform: formal changes in ministerial structure and legal mandates are necessary but not sufficient to guarantee independence and effectiveness. Long-term progress depends on consistent implementation, political will, and the cultivation of public trust in justice institutions.

5. Sentencing Practice and Crime Trends

Sentencing practice in Georgia has evolved significantly over the last two decades, shaped by legislative reforms, judicial discretion, and shifting political priorities. The Criminal Code of Georgia provides for a broad spectrum of principal and additional sanctions, including fines, community service, corrective labor, deprivation of rights, house arrest, restriction of military service, fixed-term imprisonment, life imprisonment, and confiscation of property (Criminal Code of Georgia, 1999, Articles 39–46). The variety of sanctions reflects an intention to balance punitive measures with rehabilitative and restorative options.

Trends in Custodial and Non-Custodial Sanctions.

From 2000 to 2012, Georgia experienced an era of punitive sentencing. Custodial sanctions dominated, and pre-trial detention was frequently applied, even in cases where non-custodial measures could have been sufficient (Human Rights Watch, 2006). As a result, the prison population increased dramatically, with Georgia reaching one of the highest incarceration rates in Europe—547 prisoners per 100,000 population in 2011 (World Prison Population List, 2016). This trend coincided with the government's "zero tolerance" policy, which emphasized harsh penalties for even minor crimes (Saakashvili, 2006).

The 2012–2013 amnesty and expanded parole programs marked a turning point. Following these reforms, the share of custodial sentences declined, while non-custodial sanctions such as fines, conditional sentences, and community service became more common (Supreme Court of Georgia, 2013; 2019). This liberalization of sentencing reflected both political change and increasing recognition of the need for alternatives to imprisonment, in line with European standards.

Crime Categories and Patterns.

Statistical data reveal important shifts in crime trends during this period. Property crimes, such as theft and robbery, consistently represented a significant share of convictions. Drug-related offenses also featured prominently, reflecting both the prevalence of narcotics in Georgian society and the government's strong punitive response. In 2005, the Criminal Code was amended to criminalize membership in criminal organizations, targeting the so-called *"thieves-in-law"* (Nordin & Glonti, 2006). This measure underscored the state's determination to dismantle organized crime networks that had exerted considerable influence during the post-Soviet transition.

At the same time, corruption-related offenses and abuse of official authority were prosecuted more frequently in the mid-2000s, as part of the broader anti-corruption campaign following the Rose Revolution. This campaign was instrumental in reshaping Georgia's international image, though critics argued that prosecutions sometimes reflected political motivations rather than purely legal considerations.

Judicial Independence and Sentencing Practice.

The shift in sentencing trends after 2012 also coincided with increased judicial independence. Judges, no longer constrained by rigid political directives, exercised broader discretion in applying non-custodial sanctions. According to Supreme Court statistics, conditional sentences and fines grew steadily in proportion, while imprisonment sentences dropped from being the overwhelming majority of penalties to a more balanced share by 2019 (Supreme Court of Georgia, 2019). This evolution suggested a gradual cultural shift toward a more rehabilitative model of justice.

Impact of Constitutional Court Rulings.

Landmark decisions of the Constitutional Court also influenced sentencing trends. In 2017 and 2018, the Court decriminalized and de-penalized the consumption of cannabis, ruling that punishment for personal use violated constitutional rights (Constitutional Court of Georgia, 2017; 2018). Although cultivation and sale remained illegal, these decisions had a significant effect on reducing recorded convictions for drug use, reflecting a broader movement toward liberalization in Georgian criminal law.

Despite these positive shifts, challenges persist. The abolition of certain sanctions, such as short-term imprisonment in 2006 and restriction of liberty in 2018, reduced the variety of available sentencing options, limiting judicial flexibility (Criminal Code of Georgia, 1999, Articles 41–46). Furthermore, while community service and probation have expanded, infrastructure and support programs have lagged, raising concerns about the effectiveness of non-custodial measures (Council of Europe, 2018). Recidivism rates also suggest that sentencing reforms, while reducing incarceration, have not fully addressed the root causes of criminal behavior, such as unemployment, lack of education, and insufficient rehabilitation services.

In sum, sentencing practice in Georgia demonstrates a shift from punitive to more balanced approaches, with greater reliance on non-custodial sanctions and judicial discretion. However, sustaining this progress requires continued investment in probation, community programs, and systemic safeguards to ensure that sentencing practices promote rehabilitation, reduce re-offending, and maintain public trust.

6. Long-Term Imprisonment Patterns

Long-term imprisonment has been one of the defining characteristics of Georgia's criminal justice system. According to the Council of Europe, long-term imprisonment refers to sentences exceeding five years, and Georgia has consistently recorded a high proportion of such penalties in comparison with European averages.

Dominance of Long-Term Sentences.

Statistics from the Supreme Court of Georgia show that throughout the 2010s, the majority of prisoners served terms longer than five years (Supreme Court of Georgia, 2016; 2019). This trend reflects the com-

bined effects of legislative design, prosecutorial practice, and a legacy of punitive sentencing policies from the mid-2000s. For example, property crimes and drug-related offenses often carried custodial penalties, while repeat offenders were frequently sentenced to lengthy prison terms.

Impact of the 2012–2013 Amnesty.

The large-scale amnesty and presidential pardons following the 2012 parliamentary elections had a profound impact on prison demographics. Thousands of prisoners were released, including many serving shorter sentences, which resulted in a relative increase in the proportion of long-term prisoners among the remaining population (Supreme Court of Georgia, 2013). This statistical effect partly explains why the category of long-term imprisonment appears so prominent in post-2013 data. While the amnesty successfully reduced overcrowding and addressed concerns about human rights violations, it also highlighted the structural dependence of the system on punitive sanctions.

Challenges of Rehabilitation.

Long-term imprisonment presents unique challenges for rehabilitation. Prolonged custodial sentences often weaken prisoners' social ties, reduce employability, and increase the risk of recidivism after release. Human Rights Watch (2006) and the Public Defender of Georgia (2013) emphasized that the Georgian penitentiary system lacked adequate educational, vocational, and psychological programs to prepare long-term prisoners for reintegration. As a result, many offenders released after serving extended terms struggled to reintegrate into society, contributing to cycles of re-offending.

Council of Europe Standards.

The Council of Europe has consistently stressed that long-term imprisonment should not be purely punitive but must serve the rehabilitative aim of preparing prisoners for eventual release. In its annual reports, the CPT noted that the Georgian system often prioritized containment and discipline over reintegration (CPT, 2012). In practice, rehabilitation programs remained limited in scope and availability, particularly outside the capital. Even where programs existed, such as vocational training or psychological counseling, they often lacked continuity and sufficient resources to make a meaningful impact.

Balancing Severity and Proportionality.

The prevalence of long-term imprisonment in Georgia raises broader questions about proportionality. While certain serious offenses—such as murder, trafficking, or large-scale corruption—may justifiably warrant extended sentences, the frequent imposition of long terms for less severe crimes undermines the principle of individualized sentencing. Judges, although more independent after 2012, continued to operate within a legislative framework that prescribed high minimum penalties for many offenses (Criminal Code of Georgia, 1999, Articles 33, 50, 59).

Critical Assessment.

The reliance on long-term imprisonment highlights the tension within Georgia's justice system between punitive traditions and reform-oriented policies. While amnesties and parole have reduced overcrowding, they have not fundamentally altered sentencing practices that favor long custodial terms. Addressing this imbalance requires reforming the Criminal Code to expand judicial discretion, promoting the use of non-custodial sanctions, and investing in meaningful rehabilitation programs within prisons. Without these measures, long-term imprisonment risks remaining a barrier to reintegration, perpetuating cycles of recidivism, and undermining the rehabilitative goals of modern criminal justice.

7. The Penitentiary System

The penitentiary system in Georgia plays a central role in the administration of criminal justice, as it is where sentences are executed and where the balance between punishment, security, and rehabilitation must be achieved. Its development over the last three decades illustrates both institutional modernization and persistent systemic shortcomings.

Legal Framework and Oversight.

The penitentiary system is governed by the Code of Imprisonment of Georgia (2010), which sets out rules for detention, living standards, and rehabilitation. According to Article 6(2), the Special Penitentiary Service (SPS) of the Ministry of Justice manages all penitentiary institutions. Directors of prisons are appointed by the Minister of Justice on the recommendation of the Director General of the SPS, reflecting the centralized nature of governance (Code of Imprisonment, 2010, Article 8(2–7)). Despite this centralization, the Code emphasizes legality, equality, and respect for human dignity as guiding principles (Code of Imprisonment, 2010, Article 15).

Structure and Capacity.

Georgia currently operates 13 penitentiary institutions: ten in the eastern part of the country and three in the west. These include closed, semi-open, and low-risk facilities, as well as specialized institutions for women and juveniles. The Rustavi No. 5 prison serves as the only women's establishment, while the Tbilisi No. 11 facility is designated for juveniles (Order of the Minister of Corrections, 2015). Medical services are provided through the Central Prison Hospital No. 18, which merged with the TB Treatment and Rehabilitation Center No. 19 in 2020 (Ministry of Corrections, 2020). The official total capacity is approximately 11,851 places, with minimum living space requirements of 4 m² per convicted prisoner and 3 m² per detainee (Code of Imprisonment, 2010, Article 15(2–3)).

Segregation and Categorization.

The penitentiary system applies strict segregation rules to ensure security and protect vulnerable groups. Separate facilities or units are designated for women, juveniles, first-time offenders, former law-enforcement officers, and prisoners with contagious diseases (Code of Imprisonment, 2010, Articles 9, 50, 57). This categorization is intended to reduce risks of violence, prevent recidivism within prisons, and provide conditions appropriate to different prisoner groups. For example, female juveniles are placed in a separate unit at Rustavi No. 5 to ensure protection from adult inmates (Ministerial Order No. 106, 2015).

Conditions and International Monitoring.

Despite formal improvements, conditions in Georgian prisons have often been the subject of domestic and international criticism. Reports by the Committee

for the Prevention of Torture (2012) and the Public Defender of Georgia (2013) highlighted persistent problems of overcrowding, inadequate sanitation, insufficient healthcare, and poor living conditions. Although the 2012–2013 amnesty and increased use of parole reduced overcrowding, issues such as limited natural light, ventilation, and restricted access to rehabilitative activities remained unresolved in several institutions.

Healthcare Provision.

Healthcare has been a particularly sensitive area. While legislation guarantees access to medical care equivalent to that available in the wider community (Code of Imprisonment, 2010, Article 71), implementation has lagged. Prisoners often faced delays in receiving treatment, inadequate facilities for chronic illnesses, and shortages of specialized medical staff. The merging of prison medical services with the general healthcare system was intended to improve efficiency, but resource constraints and coordination difficulties continued to undermine outcomes.

Women and Juveniles.

Special attention has been given to women and juvenile prisoners. The Rustavi No. 5 prison for women provides separate units for mothers with infants, while the juvenile facility in Tbilisi emphasizes rehabilitation and education. However, NGOs and monitoring bodies have pointed out that resources remain inadequate, particularly for vocational and psychological support programs targeting young offenders. Juvenile justice reform remains a priority area, with international actors such as UNICEF and the Council of Europe calling for expanded diversion programs and alternatives to incarceration.

Critical Assessment.

The penitentiary system in Georgia thus reflects both progress and challenges. Institutional modernization, such as the establishment of specialized facilities and stricter segregation rules, has improved compliance with international standards on paper. However, monitoring reports show that implementation continues to lag, particularly in areas of healthcare, rehabilitation, and infrastructure. Without sustained investment and independent oversight, prisons risk remaining punitive rather than rehabilitative spaces, undermining the broader goals of justice reform.

8. Parole and Recidivism

Parole has become one of the most important tools for transforming Georgia's criminal justice system from a punitive to a rehabilitative model. It is legally regulated by the **Code of Imprisonment**, which defines eligibility criteria, conditions for release, and decision-making procedures (Code of Imprisonment, 2010, Article 50(1–2)). Parole is framed as a **conditional privilege**, not an automatic right, granted only where the prisoner demonstrates progress in rehabilitation and where risks to society can be managed.

Pre-2012 Punitive Approach.

Before the political changes of 2012, parole was rarely applied in practice. Under the "zero tolerance" policy, prisoners often served full terms, and conditional release was granted sparingly. International organizations repeatedly criticized this restrictive approach, arguing that it led to **overcrowding**, undermined incentives for rehabilitation, and failed to align with European standards (Human Rights Watch, 2006; CPT, 2012).

The 2012–2013 Turning Point.

The shift in 2012–2013 marked a **policy inflection point**. Large-scale amnesties and presidential pardons, combined with a more liberal approach to parole, dramatically reduced the prison population (Supreme Court of Georgia, 2013; Special Penitentiary Service, 2020). Thousands of prisoners were released, and parole began to function as a genuine mechanism of early release rather than an exceptional measure. However, the sudden scale of releases also overwhelmed probation services, which lacked the capacity to provide effective supervision and support (National Probation Agency, 2020).

Current Trends and Practices.

Since 2014, parole has stabilized as a **routine pathway out of custody**. Decision-making boards consider a prisoner's disciplinary record, risk of re-offending, offense type, and sentence proportion served. Yet international experts emphasize that decisions should be guided by **individualized sentence planning**, validated risk assessments, and transparent reasoning (Canton & Gandidni, 2010; Criminal Justice Reform Strategy, 2013, p. 5). In practice, parole remains unevenly applied, with critics pointing to opaque criteria and occasional perceptions of favoritism.

Post-Release Supervision.

Once granted parole, supervision passes to the **National Probation Agency (NPA)**. Officers are tasked with enforcing reporting requirements, monitoring compliance with conditions, and facilitating reintegration. However, **high caseloads**, particularly in Tbilisi and other urban centers, have strained the agency's ability to provide tailored supervision (NPA, 2020). This problem has been highlighted in **Council of Europe reports**, which stress that probation should not be reduced to control, but should actively support rehabilitation and reintegration (Council of Europe, 2018).

Recidivism Challenges.

Recidivism remains a pressing issue in Georgia. Many parolees and released prisoners re-offend due to **structural barriers**: lack of employment, housing instability, substance abuse, and weak social support networks (Public Defender of Georgia, 2013). Rehabilitation programs inside prisons—such as vocational training, education, or psychological counseling—are underdeveloped, and continuity of services after release is weak. As a result, parole sometimes functions more as a **population-management tool** than as a genuine rehabilitative pathway.

Equity and Proportionality.

Concerns have also been raised about the **equity of access to parole**. Some prisoners, particularly those with resources or strong legal representation, appear better positioned to benefit from parole opportunities. Others face stricter conditions or more intensive supervision requirements, creating disparities that undermine public trust. SPACE II (2018) recommended introducing **graduated, proportionate conditions** and ensuring transparency to avoid inequities.

Path Forward.

To strengthen parole as a driver of rehabilitation rather than simply a relief mechanism for overcrowding, Georgia must:

1. **Embed individualized sentence plans** from the start of imprisonment, linking in-prison programs to post-release goals.
2. **Invest in probation services**, reducing caseloads and enhancing training for officers.
3. **Expand vocational and educational programs**, both in custody and in the community.
4. **Increase transparency** in parole board decisions by publishing clear criteria and reasoning.
5. **Introduce proportional responses** to non-compliance, preventing minor violations from leading to full re-incarceration.

In sum, parole is no longer a marginal instrument but a central feature of Georgia's criminal justice reform. Its true potential, however, depends on strengthening supervision, improving rehabilitation programs, and ensuring equity, so that parole reduces **recidivism** not merely by shortening prison terms but by genuinely supporting offenders in building law-abiding lives.

9. Probation System

The probation system represents one of the most important pillars of Georgia's criminal justice reforms, serving as the main institutional mechanism for the execution of **non-custodial sentences** and the supervision of parolees. Its legal framework is defined by the **Law of Georgia on Crime Prevention, Procedures on Execution of Non-custodial Penalties and Probation** (2007), which outlines the principles, functions, and scope of probation (Articles 1, 2, 4, 12). The law reflects Georgia's attempt to modernize its sanctioning system by shifting from a prison-centered model toward community-based justice.

Institutional Structure.

The **National Probation Agency (NPA)**, operating under the Ministry of Justice, is responsible for administering probation nationwide. By 2020, it maintained **11 regional bureaus**, staffed with probation officers, social workers, and administrative personnel (NPA, 2020). Each bureau supervises offenders serving non-custodial sanctions, parolees released under conditional terms, and individuals subjected to alternative measures such as community service.

Workload and Capacity Issues.

One of the most pressing challenges has been **high caseloads**, particularly in Tbilisi, where a single officer may supervise dozens of offenders simultaneously. This workload limits the ability of probation officers to conduct meaningful interventions beyond administrative monitoring. International experts, including the **Council of Europe**, emphasize that effective probation requires manageable caseloads to allow for individualized supervision and case management (Council of Europe, 2018). Without such adjustments, probation risks being reduced to bureaucratic oversight rather than a rehabilitative service.

Equity and Access Concerns.

Equity concerns have also emerged within the probation framework. In some instances, probationers with financial resources are able to secure reduced reporting frequencies or more favorable supervision conditions, creating disparities between offenders. This undermines the principle of equal treatment before the law and raises broader questions about fairness and public trust. The **Public Defender of Georgia** has echoed these concerns, calling for clear, standardized criteria to prevent socio-economic status from influencing probation outcomes (Public Defender of Georgia, 2013).

Rehabilitation and Social Support.

Although the legislative framework envisages probation as both supervisory and rehabilitative, practice often tilts heavily toward control. Rehabilitation programs—such as vocational training, psychological counseling, and addiction treatment—remain limited in scale and unevenly distributed across the country. Where programs exist, they frequently rely on donor funding or international partnerships rather than stable state investment. This lack of continuity reduces their long-term impact on reducing recidivism.

European Standards and Monitoring.

Comparative data from the **Council of Europe Annual Penal Statistics (SPACE II, 2018)** show that probation systems in Europe function most effectively where supervision is balanced with **supportive interventions**, tailored to the needs and risks of offenders. For Georgia, this means investing in skills development, employment opportunities, and social integration pathways for probationers. The **opinions of COE experts Canton & Gandidni (2010)** specifically advised Georgia to enhance training for probation officers, ensure multi-disciplinary teamwork, and expand community resources to support reintegration.

Critical Assessment.

The probation system has made notable progress since its establishment, providing a viable alternative to imprisonment and helping reduce prison overcrowding. However, its effectiveness is undermined by **heavy workloads**, **resource shortages**, and **equity concerns**. Without stronger rehabilitative programming and transparent, standardized practices, probation risks functioning as a mere administrative extension of the prison system rather than as a transformative tool of justice.

Way Forward.

To strengthen probation in Georgia, several reforms are essential:

1. **Reduce caseloads** by increasing staffing and resources to enable individualized supervision.
2. **Standardize reporting rules** to ensure equity and prevent socio-economic disparities.
3. **Expand rehabilitative programs**, including education, vocational training, and mental health support.
4. **Invest in capacity-building** for probation officers, focusing on counseling and case management skills.
5. **Enhance coordination** with NGOs and community services to provide a network of support for probationers.

In this way, probation can fulfill its dual mandate of supervision and rehabilitation, serving not only as an alternative to custody but as a genuine pathway to reintegration and reduced recidivism.

10. Recommendations

The trajectory of Georgia's criminal justice reform highlights both progress and gaps. To consolidate

achievements and address systemic shortcomings, the following recommendations are advanced:

10.1. Expand Alternatives to Custody

Georgia must further diversify and strengthen alternatives to imprisonment, in line with the **Law on Crime Prevention (2007, Article 4)**. While community service, fines, and conditional sentences have gained traction, they remain underutilized relative to custodial sanctions. Expanding the use of non-custodial measures would reduce pressure on penitentiary institutions, minimize the social costs of imprisonment, and align with **Council of Europe** standards that encourage imprisonment only as a last resort.

10.2. Enhance Parole Transparency and Fairness

Parole should evolve into a more predictable and rights-based mechanism. The **Criminal Justice Reform Strategy (2013)** emphasized fairness and transparency as cornerstones of parole policy. To achieve this, parole boards should adopt clear, published criteria, document decision-making processes, and ensure consistent application across cases. Transparency would not only build public trust but also ensure that parole decisions serve rehabilitative rather than political or administrative purposes.

10.3. Invest in Rehabilitation and Education

Rehabilitation must become a genuine priority rather than an ancillary function of the penitentiary system. According to the **Special Penitentiary Service (2020)**, existing programs for vocational training, education, and psychological support are limited in scope and unevenly distributed. Expanded investment in these areas is essential to reduce recidivism and enable prisoners to reintegrate successfully. Evidence from European practice underscores that meaningful rehabilitation reduces long-term crime rates more effectively than punitive approaches.

10.4. Ensure Manageable Probation Workloads

The **National Probation Agency (2020)** continues to face significant challenges due to heavy officer caseloads, especially in Tbilisi. Excessive workloads risk transforming probation into a bureaucratic exercise rather than a rehabilitative process. Increasing staff numbers, introducing digital case-management systems, and investing in officer training would strengthen supervision and allow for individualized support. Such reforms would transform probation into a credible alternative to imprisonment and improve public confidence in community-based sanctions.

10.5. Align Penitentiary Standards with European Norms

Despite improvements since 2012, penitentiary conditions in Georgia still fall short of European standards, particularly regarding healthcare, sanitation, and rehabilitation. Reports from the **Council of Europe (2018)** emphasize the importance of aligning national practice with the European Prison Rules, ensuring dignity, proportionality, and human rights protections. Priority should be given to healthcare reform, specialized facilities for vulnerable groups, and increased independent monitoring of prison conditions.

Conclusion

The Georgian criminal justice system illustrates the complex interplay between political will, institutional reform, and international standards. Since 2006, the country has moved away from an exclusively punitive model, reducing incarceration rates, introducing jury trials, expanding parole, and strengthening probation. These reforms represent important steps toward a more balanced and rights-oriented system.

Yet critical challenges remain. Judicial independence is still contested, the penitentiary system continues to face structural weaknesses, and rehabilitation programs lack sufficient scale and resources. The prevalence of long-term imprisonment and persistent recidivism indicate that reforms have not yet fully achieved their rehabilitative aims.

Sustainable progress will depend on **evidence-based policy, institutional transparency, and continuous investment in human resources and infrastructure**. By expanding non-custodial sanctions, enhancing parole and probation, and aligning practice with European human rights standards, Georgia can build a justice system that not only punishes but also rehabilitates, reintegrates, and protects society in a fair and democratic manner.

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PAROLE SYSTEMS IN GEORGIA AND EUROPE: CHALLENGES AND COMPARATIVE PERSPECTIVES

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DOI: 10.5281/zenodo.19491278

Abstract

This article provides a comprehensive analysis of the parole system in Georgia, set against the backdrop of international and European standards. Drawing on legislation, statistical data, and monitoring reports, the article traces the historical development of parole, including its relationship to presidential pardons and amnesties, and evaluates the functioning of parole boards in practice. A comparative section examines models in the Netherlands and England and Wales, highlighting lessons for Georgia. The study emphasizes both progress and shortcomings, particularly in ensuring parole transparency, equity, and rehabilitative outcomes, and concludes with recommendations for strengthening parole as a driver of justice reform.

Keywords: Parole; Georgia; probation; amnesty; presidential pardon; prison overcrowding; rehabilitation; recidivism; comparative justice; European standards.

Introduction

Parole represents one of the most significant mechanisms for managing prison populations and promoting offender rehabilitation. In Georgia, where incarceration rates were historically among the highest in Europe, parole has been essential in addressing overcrowding and aligning the justice system with European human rights norms (Van Zyl Smit & Snacken, 2009). However, the development of parole in Georgia has been uneven, shaped by political shifts, mass amnesties, and the discretionary use of presidential pardons (Public Defender of Georgia, 2019). This article situates the Georgian parole system within its historical trajectory and compares it to European models, identifying reforms needed to ensure fairness, transparency, and effectiveness.

1. Historical Development of Parole in Georgia

The evolution of Georgia's parole system reflects the broader transformations in the country's justice and political landscape. In the immediate post-independence period of the 1990s and early 2000s, parole as a formal mechanism existed in law but remained overshadowed in practice by the widespread use of **presidential pardons** and **parliamentary amnesties**. These instruments released large numbers of prisoners en masse, often in response to political crises, humanitarian considerations, or public pressure (Levy, 2007). While effective in reducing overcrowding in the short term, they underscored the lack of an institutionalized and predictable system for conditional release.

During the mid-2000s, Georgia adopted a strict **"zero tolerance" criminal policy**, which dramatically reduced the use of parole. This punitive approach sought to demonstrate political strength and public order, with incarceration becoming the primary instrument of crime control (CPT, 2013). The result was one of the **highest incarceration rates in Europe**, combined with chronic overcrowding, deteriorating prison conditions, and frequent human rights criticisms from both domestic actors and international organizations. In this period, parole was rarely granted, and early release was perceived as an exception rather than a component of sentence execution.

A decisive **turning point came with the 2012 parliamentary elections**, which ushered in a change in political leadership and a broader criminal justice reform agenda. Public concern over prison conditions, intensified by scandals of ill-treatment in penitentiary institutions, created strong pressure for reform. In this new climate, parole began to expand significantly in both scope and application (MoJ, 2012). This expansion was part of a wider **liberalization process**, which sought not only to alleviate overcrowding but also to align Georgia's penal policies with **European human rights standards**.

The post-2012 reforms emphasized parole as a structured and judicially supervised mechanism, rather than a discretionary political act. While challenges of consistency and transparency remained, the shift represented a broader philosophical transition: parole was increasingly understood not simply as a tool for managing prison numbers, but as a pathway for **rehabilitation and reintegration** within a modern criminal justice framework.

2. Presidential Pardons and Parliamentary Amnesties

For much of the post-Soviet era, **presidential pardons** and **parliamentary amnesties** were the primary mechanisms shaping Georgia's prison population. Their extensive use reflected both the legacies of Soviet legal traditions and the state's limited institutional capacity to manage sentencing through structured parole.

Amnesties, passed periodically by Parliament, often involved the large-scale release of thousands of prisoners at once. These measures were generally justified by humanitarian motives—such as reducing overcrowding or commemorating national holidays—but they also carried a strong political dimension, allowing ruling parties to signal leniency or consolidate public support (MoC, 2012). The absence of a permanent legal framework for amnesties, with each law crafted on an ad hoc basis, highlighted their exceptional and often politically driven character.

Presidential pardons operated on a more individualized basis, but they too were marked by controversy. The President retained broad discretion to grant clemency, based on recommendations from the Pardoning Commission. While pardons could provide relief in cases of humanitarian need or miscarriages of justice,

critics—both domestic NGOs and international observers—pointed out the **lack of transparency and clear criteria** governing the process (President's Pardoning Commission, 2019). Decisions were often perceived as arbitrary, raising questions about fairness and equal treatment before the law.

The reliance on amnesties and pardons underscored two fundamental issues in Georgia's justice system. First, it revealed the **chronic problem of overcrowding**, which authorities repeatedly sought to resolve through extraordinary measures rather than systemic reform. Second, it highlighted the weakness of **institutionalized parole**, which remained underdeveloped and overshadowed by politically influenced release practices.

International monitoring bodies, including the **Council of Europe** and the **CPT**, have long stressed that reliance on extraordinary clemency measures should not substitute for regularized parole and probation mechanisms. In the European context, conditional release is conceived as part of a structured sentence management process, not as a discretionary or political favor. By contrast, in Georgia, amnesties and pardons dominated for decades, delaying the establishment of a predictable and rehabilitative parole system.

3. Emergence of Parole Boards

The **emergence of parole boards** in Georgia marked an important shift from ad hoc release mechanisms—such as presidential pardons and parliamentary amnesties—toward a more **institutionalized and rule-based system**. Beginning in the mid-2000s, the Ministry of Corrections sought to establish standing commissions that could review parole applications on the basis of defined legal provisions rather than political discretion (Order of the Minister of Corrections #585, 2009).

Composition and mandate.

Parole boards were typically composed of ministry officials, prison administration representatives, and legal experts. Their mandate included assessing an applicant's disciplinary record, time served, and participation in correctional or rehabilitative programs. Over time, the role of these boards was expanded to include the possibility of **commuting unserved portions of sentences** or replacing custodial penalties with less severe measures. This reflected an intention to integrate parole into a broader sentencing framework rather than treating it as an exceptional act of clemency.

Critiques of practice.

Despite these formal advances, **monitoring bodies and NGOs** have raised persistent concerns about how parole boards operate in practice. Reports by the **Public Defender of Georgia (2019)** noted that decisions often lacked adequate reasoning, leaving prisoners uncertain about the grounds for approval or rejection. Furthermore, a heavy reliance on **disciplinary records**—such as infractions or compliance with prison rules—risked equating conformity with genuine rehabilitation. This approach, critics argue, effectively rewards obedience to prison authority while overlooking broader indicators of social reintegration potential.

Transparency and accountability.

Another major challenge has been transparency. Unlike in many European systems, parole board deliberations in Georgia are largely closed to public scrutiny. Criteria are not always published, and applicants frequently receive little more than a brief notification of the outcome. The absence of detailed written reasoning undermines both the perceived legitimacy of parole decisions and the ability of prisoners to appeal or improve their prospects in future applications.

International comparisons.

By contrast, in countries such as **England and Wales**, parole boards operate as quasi-judicial bodies, providing detailed written justifications and allowing for adversarial hearings with legal representation (Livingstone, Owen & McDonald, 2008). Similarly, the **Netherlands** integrates parole decisions into individualized sentence plans, ensuring that release is linked to structured rehabilitation (Tak, 2008). These examples highlight how Georgia's boards, while a step forward, remain underdeveloped in terms of procedural fairness and independence.

Significance for reform.

The establishment of parole boards nevertheless signaled an **institutional maturation** of Georgia's justice system. It demonstrated an intent to shift from politically motivated releases to a system grounded in law and administrative procedure. However, without significant improvements in transparency, consistency, and integration with rehabilitation services, parole boards risk functioning as **bureaucratic gatekeepers** rather than as instruments of reintegration and human rights protection.

4. Statistical Overview of Parole and Releases

Statistical data offers critical insight into how parole and other release mechanisms have evolved in Georgia over the past two decades. These figures reveal not only shifts in penal policy but also the balance between political discretion and institutionalized decision-making.

The dominance of amnesties and pardons (1990s–2012).

Until 2012, **parliamentary amnesties and presidential pardons** were the dominant mechanisms for reducing the prison population. For example, amnesties often released **thousands of inmates at once**, sometimes cutting the prison population by double-digit percentages in a single legislative act (MoC, 2012). Presidential pardons, although smaller in scale, were frequent and wide-reaching. This heavy reliance on extraordinary measures reflected the **weak institutionalization of parole** and the pressing need to address chronic overcrowding through politically driven interventions.

The turning point of 2012–2013.

The parliamentary elections of 2012 marked a watershed moment in criminal justice reform. In 2013, a **comprehensive amnesty law** led to the release of more than half of the country's prisoners, a dramatic reduction unparalleled in Europe (Adopted Amnesty Law, 2013). At the same time, the **expanded use of parole** began to emerge as a more systematic release mechanism. Data from the **Special Penitentiary Service** show a steady increase in conditional release applications and approvals from 2013 onwards, signaling the beginning of a gradual shift away from political tools toward institutionalized processes.

Parole trends after 2013.

Between **2013 and 2019**, parole accounted for an increasingly significant proportion of prisoner releases (Public Defender of Georgia, 2019). Presidential pardons continued but declined in relative importance, while amnesties became rarer and more limited in scope. According to data provided by the **Supreme Court of Georgia**, parole decisions during this period became the principal mechanism of early release, though approval rates fluctuated year to year depending on the government's penal policy orientation.

Interpreting the numbers.

While the statistical rise of parole suggests progress, the figures also mask persistent challenges:

- Approval rates remained relatively low compared to applications, pointing to either **overly strict criteria** or procedural bottlenecks.
- Recidivism among parolees, though not systematically published, has been cited as a concern, with weak post-release supervision undermining the benefits of early release (Public Defender of Georgia, 2019).
- Disparities appeared between regions, with Tbilisi and larger urban centers accounting for a disproportionate share of parole approvals, partly due to stronger legal representation and more active civil society oversight.

Comparative perspective.

When compared with **European Union member states**, Georgia's parole usage remains less predictable. In the **Netherlands**, for instance, conditional release is almost automatic at the two-thirds point of a sentence (Padfield, Van Zyl Smit & Dunkel, 2010), ensuring consistency and transparency. In contrast, Georgian parole rates vary widely across years, reflecting both political shifts and administrative discretion.

The statistics show a **positive trend toward the normalization of parole**, but they also reveal the fragility of these reforms. While Georgia has reduced reliance on mass amnesties and presidential pardons, parole remains inconsistently applied, vulnerable to political influence, and insufficiently supported by reintegration programs.

5. Challenges of the Georgian Parole System

Despite the progress made since 2012 in institutionalizing parole, significant challenges continue to undermine its credibility, fairness, and rehabilitative function. These challenges span **procedural, socio-economic, and institutional dimensions**.

5.1. Lack of Transparency and Reasoned Decisions

One of the most persistent criticisms of the Georgian parole system is the **lack of adequate reasoning** in decisions. Applicants frequently receive only brief, formulaic explanations for rejections, making it impossible to understand the specific grounds on which the decision was based (Public Defender of Georgia, 2019). This opacity undermines the right to fair treatment and limits prisoners' ability to improve their prospects in future applications. By contrast, in European systems such as **England and Wales**, parole boards are required to issue detailed written justifications, enhancing both accountability and public trust (Livingstone, Owen & McDonald, 2008).

5.2. Over-Reliance on Disciplinary Records

Parole boards in Georgia place heavy emphasis on a prisoner's **disciplinary record**, often equating rule compliance with evidence of rehabilitation. While prison discipline is relevant, this approach fails to consider broader indicators such as psychological evaluations, vocational training, or family reintegration prospects (Order of Minister of Corrections #585, 2009). As a result, prisoners who may have shown genuine progress in addressing criminogenic needs but who committed minor infractions can be unfairly excluded. This practice risks reducing parole to a reward for obedience rather than a structured pathway toward rehabilitation.

5.3. Socio-Economic Inequalities

Equity of access is another concern. Prisoners with **financial resources** are better able to secure legal representation, present stronger applications, and navigate bureaucratic processes. Conversely, disadvantaged prisoners—particularly those from rural areas or minority groups—face greater barriers. This disparity undermines the principle of **equality before the law** and reinforces perceptions that parole can be influenced by status and connections (Public Defender of Georgia, 2019).

5.4. Weak Post-Release Support

Even when parole is granted, **post-release supervision and support remain limited**. The National Probation Agency struggles with high caseloads, leaving officers little capacity to provide tailored guidance (NPA, 2020). Moreover, access to vocational training, housing support, and psychological counseling after release is patchy and often dependent on donor-funded pilot projects rather than sustained state investment. Without these supports, many parolees fall back into cycles of unemployment, poverty, and re-offending, undermining the ultimate goal of reintegration.

5.5. Regional and Institutional Disparities

Data suggests that parole decisions may vary across regions, reflecting differences in local practices, resources, and judicial culture. This lack of consistency challenges the uniform application of justice and raises concerns about potential arbitrariness in the system. Furthermore, institutional independence of parole boards has been questioned, with critics pointing to potential **political or administrative influence** in sensitive cases (CPT, 2013).

5.6. Recidivism Concerns

Finally, parole in Georgia is often criticized for insufficient attention to **recidivism outcomes**. While early release has reduced prison overcrowding, its long-term effectiveness in reducing crime remains less clear. The absence of systematic research and transparent publication of recidivism statistics prevents a thorough evaluation of parole's impact.

Together, these issues reveal that while parole has moved beyond the era of discretionary amnesties and pardons, it has not yet matured into a fully transparent, equitable, and rehabilitative system. Addressing these weaknesses will be critical for consolidating reform and aligning Georgian practice with European human rights standards.

6. European Standards and Council of Europe Guidance

The **Council of Europe (CoE)** and the **European Court of Human Rights (ECHR)** have consistently emphasized that parole must serve as a core element of modern sentencing policy, grounded in **rehabilitation, fairness, and human rights**. For Georgia, these standards have been both a source of external pressure and a roadmap for reform.

6.1. Council of Europe Recommendations

The CoE's **Recommendation Rec(2003)22 on Conditional Release (Parole)** sets out guiding principles for member states. It underscores that conditional release should be accessible to all sentenced prisoners, based on **objective and transparent criteria**, and prepared through **individualized sentence planning**. The Recommendation also calls on states to integrate parole into the overall sentence management process, beginning at the start of imprisonment rather than as an afterthought (CoE Rec(2003)22, Arts. 16–24).

For Georgia, compliance with these principles requires not only maintaining the legal framework for parole but also embedding **structured reintegration programs**, such as vocational training, psychological counseling, and social support, to ensure that conditional release genuinely promotes desistance from crime.

6.2. European Prison Rules

The **European Prison Rules (EPR, 2006, revised 2020)** further stress the importance of preparing prisoners for release from the first day of detention. Rule 107 explicitly states that prisoners should be assisted in their return to society by means of pre-release programs and post-release supervision. In Georgia, however, such programs remain limited in scope and unevenly distributed across institutions, meaning that parole often occurs without sufficient preparation for reintegration (CPT, 2013).

6.3. CPT Monitoring Reports

The **European Committee for the Prevention of Torture (CPT)** has repeatedly highlighted the risks associated with overcrowding and inadequate rehabilitation opportunities in Georgia. In its 2012 visit report, the CPT criticized the over-reliance on amnesties and pardons as unsustainable tools for reducing prison populations, urging instead the development of **systematic parole mechanisms** supported by robust probation services (CPT, 2013).

6.4. European Court of Human Rights Jurisprudence

The ECtHR has reinforced these principles in landmark cases such as **Leger v. France (2006)** and **Thynne, Wilson and Gunnell v. the United Kingdom (1990)**, which held that denial of a real prospect of release violates Article 5 of the European Convention on Human Rights. These judgments establish that prisoners must not only have a legal possibility of parole but also a **fair and transparent process** for its consideration. Georgia's parole boards, with their limited reasoning and opaque procedures, still fall short of these standards.

6.5. Implications for Georgia

Aligning with European standards requires Georgia to:

- Ensure that **all prisoners** serving fixed-term or life sentences have a realistic opportunity to apply for parole.
- Provide **clear, published criteria** for decision-making, with reasoned outcomes available to applicants.
- Expand access to **rehabilitation and reintegration programs**, linking them directly to parole eligibility.
- Guarantee the **independence and impartiality** of parole boards, free from political or administrative interference.

Incorporating European standards into Georgian practice is not merely a question of compliance; it is a condition for building a **credible and humane justice system**. Without transparent procedures, effective preparation for release, and strong community supervision, parole risks remaining a formal right with limited practical value.

7. Comparative Perspective: The Netherlands

The Netherlands has long been regarded as a model of **structured conditional release**, embedding parole within a broader philosophy of rehabilitation and reintegration. Unlike Georgia, where parole developed in response to overcrowding and political shifts, the Dutch system has been carefully integrated into **sentence management policy**, emphasizing predictability and fairness.

7.1. Legal Framework

Under Dutch law, prisoners serving fixed-term sentences are typically **eligible for conditional release after serving two-thirds** of their sentence, unless there are compelling reasons to deny it (Padfield, Van Zyl Smit & Dunkel, 2010). This semi-automatic system contrasts sharply with Georgia, where parole remains largely discretionary and often opaque. By ensuring that most prisoners have a realistic prospect of release, the Netherlands reduces uncertainty and incentivizes positive behavior in custody.

7.2. Individualized Reintegration Planning

Parole in the Netherlands is not treated as a discretionary favor but as an **integral stage of the sentence**. From the beginning of incarceration, prisoners work with case managers to develop **individualized reintegration plans**, which may include vocational training, therapy, addiction treatment, and structured pre-release programs (Tak, 2008). These plans are then linked to parole conditions, ensuring continuity between custody and community supervision. This approach ensures that release is not simply about reducing prison numbers, but about preparing offenders for law-abiding lives.

7.3. Decision-Making and Supervision

While conditional release is generally granted, Dutch authorities may postpone or deny parole in cases of **serious risk to public safety** or persistent non-compliance with prison programs (Flight et al., 2011). Once released, parolees are supervised by the **Probation Service of the Netherlands (Reclassering Nederland)**, which enforces conditions such as reporting requirements, electronic monitoring, or mandatory participation in rehabilitation programs. The emphasis is on balancing control with support.

7.4. Transparency and Accountability

The Dutch system is also marked by **high levels of transparency**. Decisions are grounded in published criteria, with avenues for appeal and review. Prisoners know from the outset of their sentence when they will likely be eligible for release and what they must do to prepare. This predictability contrasts with Georgia, where parole decisions often appear arbitrary or inconsistent.

7.5. Outcomes and Effectiveness

Research has shown that the Dutch conditional release system contributes to **lower recidivism rates**, particularly among prisoners who engage with reintegration programs (Sagel-Grande, 2010). The structured use of parole has also helped maintain relatively low incarceration rates compared to other European states.

7.6. Lessons for Georgia

The Dutch experience offers several key lessons for Georgia:

- Parole should be treated as a **normal stage of sentence execution**, not an exceptional measure.
- **Individual sentence planning** should begin at the start of imprisonment and be linked directly to parole eligibility.
- **Transparency and predictability** are essential to building legitimacy and motivating prisoners to engage in rehabilitation.
- Effective parole requires **well-resourced probation services** capable of balancing supervision with support.

By embedding conditional release into a structured, transparent, and rehabilitative framework, the Netherlands demonstrates how parole can function as both a tool of social reintegration and a safeguard against arbitrary detention. For Georgia, adopting similar principles would help transform parole from a discretionary privilege into a **cornerstone of modern justice policy**.

8. Comparative Perspective: England and Wales

The parole system in **England and Wales** provides a contrasting model to both Georgia and the Netherlands. It is characterized by **judicial-style procedures**, strong emphasis on **due process**, and extensive use of **oral hearings**. While not without its flaws, the system demonstrates how transparency and accountability can enhance both public confidence and the protection of prisoners' rights.

8.1. Legal Framework

The foundation of conditional release in England and Wales lies in the **Criminal Justice Act 1967** and subsequent reforms, particularly the **Criminal Justice Act 2003**. Prisoners serving determinate sentences may be considered for early release on licence, while those serving indeterminate sentences must demonstrate reduced risk before parole can be granted (Livingstone, Owen & McDonald, 2008). This risk-based approach differs from Georgia's still-developing model, which often lacks systematic risk assessments.

8.2. The Role of the Parole Board

The **Parole Board for England and Wales** operates as an independent, quasi-judicial body. Its members include judges, psychologists, criminologists, and lay experts, ensuring multidisciplinary expertise in decision-making (Justice, 2009). The independence of the Parole Board provides an important safeguard against political interference—an area where Georgia continues to face challenges in ensuring impartiality and public trust.

8.3. Oral Hearings and Due Process

A defining feature of the English parole system is the use of **oral hearings**, which allow prisoners to present their cases directly, often with legal representation. These hearings are adversarial in nature: the state must justify continued detention, and prisoners have the right to challenge evidence against them. This practice, affirmed in **Osborn v. The Parole Board (2013)**, ensures that parole is not merely an administrative decision but a **fair, transparent process** consistent with Article 5 of the European Convention on Human Rights.

8.4. Transparency and Accountability

Although criticisms remain about delays and resource constraints, England and Wales have made significant strides in transparency. Annual reports of the Parole Board are published, alongside data on decisions, success rates, and appeals (Parole Board for England and Wales, 2013). Furthermore, judicial review provides a legal avenue for challenging flawed decisions, enhancing accountability. This contrasts with Georgia's opaque decision-making process, where prisoners often lack access to clear reasoning behind parole rejections.

8.5. Victim Involvement

Since reforms in the early 2000s, victims have gained increasing opportunities to participate in parole hearings by submitting written statements or attending proceedings. This integration of victim perspectives demonstrates a commitment to balancing offender rehabilitation with the rights of victims—a practice not yet systematically adopted in Georgia.

8.6. Lessons for Georgia

The English experience suggests several key reforms Georgia could adopt:

- Establish a **parole body independent of executive power**, staffed with legal, psychological, and correctional experts.
- Institutionalize **oral hearings** with guaranteed legal representation for prisoners.
- Publish **annual statistics and reports**, providing transparency and public accountability.
- Consider **victim participation** in parole hearings, while safeguarding fairness for the prisoner.

England and Wales illustrate how parole can be framed as a **judicially supervised right** rather than a discretionary act of leniency. By ensuring adversarial hearings, independent decision-making, and transparency, their system provides a valuable model for Georgia as it seeks to strengthen the rule of law and align with European human rights standards.

9. Critical Assessment and Reform Needs

Georgia's parole system reflects meaningful progress, especially since the **post-2012 liberalization**, which sought to reduce reliance on presidential pardons and parliamentary amnesties. The creation of parole boards and formalized procedures signaled a shift toward **institutionalization and rule-based governance**. Nevertheless, several critical challenges remain.

First, **transparency and accountability** are limited. Decisions of parole boards are often poorly reasoned, with applicants left uncertain about why parole was denied. This lack of clarity undermines both legitimacy and the rehabilitative purpose of parole (Public Defender of Georgia, 2019).

Second, **rehabilitation and reintegration programs** remain underdeveloped. Unlike in European systems where conditional release is tied to individualized sentence planning, in Georgia parole frequently occurs without sustained access to vocational training, addiction treatment, or post-release support services. This gap weakens parole's effectiveness in reducing recidivism (Van Zyl Smit & Snacken, 2009).

Third, **equity concerns** persist. Reports indicate disparities in access to parole, with certain groups—such as those unable to afford legal representation—facing systemic disadvantages. Moreover, women and juveniles encounter distinct challenges due to limited facilities and tailored reintegration support (Public Defender of Georgia, 2019).

Finally, the parole system remains **overly linked to prison population management** rather than being embedded as a structured part of sentence execution. While reductions in overcrowding are important, the risk is that parole becomes a tool for relieving pressure on institutions rather than a genuine pathway toward reintegration.

In sum, while Georgia has made notable strides, the parole system is still transitioning from a **formal right** into a **functioning, rehabilitative institution**.

10. Recommendations

Drawing on the analysis and comparative perspectives, several **strategic recommendations** emerge:

- **Expand alternatives to custody.** The Law on Probation (2007) provides a legal basis for non-custodial measures. Georgia should broaden their application to reduce unnecessary incarceration and ensure proportional sentencing.
- **Enhance parole board transparency.** The Order of the Minister of Justice #320 (2018) should be fully implemented with mandatory publication of decision criteria, reasoned judgments, and clear appeals procedures, thereby reinforcing accountability.
- **Strengthen rehabilitative programming.** The Special Penitentiary Service (2019) should invest in vocational training, educational programs, addiction treatment, and psychological services, ensuring that parole decisions are linked to demonstrated progress in rehabilitation.
- **Ensure equity of access.** Special measures should be adopted to guarantee that socio-economic status does not affect parole eligibility or outcomes. Public Defender reports (2019) suggest creating state-funded legal aid pathways for parole applicants.
- **Align with European standards.** Full compliance with **CoE Rec(2003)22** and the **European Prison Rules (2020)** is necessary. This includes systematic sentence planning, access to parole for all prisoners, and fair procedures overseen by independent bodies.

Taken together, these reforms would strengthen the parole system, making it more **predictable, fair, and effective**, while simultaneously building public confidence in justice institutions.

Conclusion

The development of parole in Georgia encapsulates the broader challenges of criminal justice reform: balancing **security, efficiency, and human rights**. Since 2012, the system has evolved from reliance on mass amnesties and presidential pardons toward a more structured framework. Yet, substantial shortcomings persist in **transparency, equity, and rehabilitative depth**.

Comparative experiences highlight the way forward. From the **Netherlands**, Georgia can learn the value of **structured reintegration planning** and predictable parole timelines. From **England and Wales**, the importance of **adversarial hearings, independent decision-making, and victim participation** emerges as a safeguard of fairness and legitimacy.

Ultimately, sustainable reform in Georgia will depend on embedding European principles of **fairness, accountability, and rehabilitation** into both law and practice. Parole must be more than a tool of population control; it must serve as a **human rights safeguard and a mechanism of reintegration**, ensuring that released prisoners return to society with real prospects for law-abiding lives.

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MEDICAL SCIENCES

CONTEMPORARY APPROACHES IN THE MEDICAL AND SURGICAL MANAGEMENT OF ACUTE APPENDICITIS

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DOI: 10.5281/zenodo.19491283

Abstract

Acute appendicitis is one of the most common general surgical emergencies worldwide, with an increasing incidence, and pediatric appendectomy represents the most frequent abdominal procedure in this category.

The specialized literature highlights significant gaps in the optimal management of the condition, including decisions between surgical and conservative treatment, timing of intervention, indications for interval appendectomy, preoperative preparation, surgical approach in high-risk patients (open versus laparoscopic), intraoperative techniques, postoperative use of antibiotics, and the necessity of drain placement.

Although open appendectomy remains the classical standard, laparoscopic surgery has become increasingly utilized, offering advantages such as reduced surgical trauma, improved visualization of abdominal organs, and lower rates of postoperative complications. However, the applicability of laparoscopy in complicated appendicitis and the secure closure of the appendiceal stump remain subjects of debate.

In conclusion, despite being well-studied, acute appendicitis continues to generate controversy regarding the optimal therapeutic approach, with the literature often reporting conflicting results.

Keywords: acute appendicitis, pediatric appendectomy, laparoscopic surgery, open appendectomy, appendiceal stump closure, surgical management, postoperative complications.

Acute appendicitis represents one of the most common indications for emergency abdominal surgery in children worldwide, with appendectomy being considered the traditional standard of treatment. Errors in diagnosing this condition may lead either to appendectomies performed on a normal appendix or to missed cases of appendicitis – situations that constitute some of the main reasons for malpractice litigation, particularly in the United States [69].

The specialized literature contains numerous gaps regarding the optimal management of acute appendicitis, including decisions related to the preferred therapeutic option (surgical versus conservative), the optimal timing for performing appendectomy, the indications and timing of interval appendectomy, preoperative management, the choice of surgical approach in high-risk patients (open versus laparoscopic), intraoperative techniques, and the use of antibiotics in the postoperative period [82, 17]. The American College of Surgeons' National Surgical Quality Improvement Program – Pediatrics (NSQIP-P) has defined the intraoperative criteria for complicated appendicitis, including appendicitis with gangrenous changes, necrosis, or visible perforation of the appendix, intraperitoneal abscess, extraluminal fecalith, and diffuse fibrinopurulent exudate. Approximately 25–30% of appendicitis cases in children are complicated and represent the main cause of morbidity and increased utilization of medical resources [29, 50].

According to international guidelines, surgical intervention is recommended for early-stage complicated acute appendicitis (duration of symptoms ≤72 hours), including cases of periappendiceal phlegmon. In contrast, advanced stages of complicated appendicitis (duration of symptoms >72 hours) or cases with periappendiceal abscesses are usually managed conservatively, through percutaneous drainage and administration of antibiotics [51].

Patients with complicated forms of acute appendicitis (appendiceal phlegmon or abscess) generally require appendectomy to relieve symptoms and prevent complications such as peritonitis. Surgical intervention may be performed early (immediately or a few days after admission) or delayed (several weeks later, following conservative treatment). However, the optimal timing for appendectomy in cases of appendiceal phlegmon or abscess remains a debated issue [94, 93]. In this context, there is a lack of robust data regarding the outcomes of patients with complicated acute appendicitis who are treated surgically instead of through a conservative approach. Evaluating the benefits and risks associated with each therapeutic option is essential, highlighting the need for further research and the development of optimized protocols to improve clinical outcomes [52].

The option of non-operative treatment for acute appendicitis is not a recent concept. The first documented case of spontaneous resolution of complicated acute appendicitis was published in 1910 by Smith and Wood Jones. Later, in 1930, Bailey proposed his own algorithm for non-surgical treatment, and in 1959 Coldrey first described a significant series of 471 patients treated conservatively with intravenous antibiotics [15, 91].

Currently, cases of uncomplicated acute appendicitis can be effectively treated with antibiotics until complete resolution of the disease and patient discharge, a concept widely discussed in the scientific lit-

erature [56, 18]. If antibiotic treatment can cure the disease, it would be reasonable to consider that surgical intervention may no longer represent an immediate emergency.

However, the main concern remains the timing of appendectomy, as there is a risk that non-perforated appendicitis may progress to perforation in cases where surgery is delayed. Some studies have confirmed that prolonged in-hospital waiting time before surgery is associated with a higher rate of perforation in children [75]. According to some studies, approximately one-third of patients initially treated with antibiotics subsequently required appendectomy, while two-thirds avoided surgery over the course of one year; however, the available evidence remains uncertain [22]. Although the cure rate with conservative treatment is lower than that achieved through surgery, antibiotics represent a reasonable option for patients with uncomplicated acute appendicitis who wish to avoid surgery and do not present additional risk factors [54, 87].

Recent meta-analyses have shown that antibiotics as an initial treatment for children with uncomplicated appendicitis may be feasible and effective without increasing the risk of complications. Nevertheless, the failure rate of conservative treatment – mainly determined by the presence of an appendicolith – is higher than that associated with appendectomy, and surgical intervention remains recommended in such situations [34, 12]. During the initial hospitalization, conservative treatment may fail in approximately 8% of cases, and up to 20% of patients may require readmission for recurrent appendicitis [60].

Therefore, emergency appendectomy remains the standard approach for the treatment of acute appendicitis, particularly in complicated cases [43]. Although gangrenous appendicitis is often considered together with perforated appendicitis, some studies suggest that the risk of postoperative infection in gangrenous appendicitis is comparable to that of simple appendicitis. In such situations, treatment without postoperative antibiotics may be appropriate, contributing to a reduction in the length of hospital stay and antibiotic use without significantly increasing the risk of infections or readmissions [58].

A meta-analysis that included two randomized controlled clinical trials on complicated acute appendicitis showed that early appendectomy is recommended for children with perforated appendicitis without an abscess at presentation. In contrast, for children presenting with an intra-abdominal abscess, the controversy between early appendectomy and interval appendectomy persists, as there is no convincing evidence indicating major differences between the two approaches. This situation highlights the need for high-quality randomized studies to clarify the risks and benefits of surgical versus conservative treatment in complicated appendicitis [15, 91].

Before the advent of laparoscopic surgery, it was common practice to remove the appendix even when it appeared normal in order to prevent future diagnostic confusion, as the appendectomy scar could be misleading. The removal of a histologically normal appendix was referred to as a negative appendectomy. In the medical literature, the rate of negative appendectomy varies between 1.8% and 46%, being higher in children. Although it may seem useful, negative appendectomy is associated with subsequent complications in approximately 6% of patients [39, 2]. In 10–20% of laparoscopic explorations performed for right lower quadrant abdominal pain, the appendix appears normal and no other intra-abdominal pathology is identified.

Opinions regarding the management of a normal-appearing appendix differ: some authors, in the case of adult patients, recommend its removal [23], while others consider that appendectomy is not justified [84]. Available data suggest that a macroscopically normal appendix may be left *in situ* during laparoscopy in children and adolescents with suspected appendicitis, without the need for a subsequent surgical intervention. However, these conclusions are based on a limited number of patients, and studies with larger cohorts are needed for validation [21]. At present, the identification of a macroscopically normal appendix during laparoscopy for right iliac fossa pain in children represents a clinical dilemma, as there is no universally accepted protocol, and the long-term consequences of leaving the appendix *in situ* remain unclear [2].

With regard to uncomplicated appendicitis, laparoscopic appendectomy remains the standard initial treatment. Faster recovery, reduced postoperative pain, and the prompt return of intestinal function compared with open surgery make this procedure the preferred approach in children [63].

In 1997, Horwitz J.R. and colleagues recommended avoiding laparoscopic appendectomy in children with a preoperative diagnosis of complicated appendicitis and suggested early conversion to open appendectomy in cases where a complicated form of the disease was identified intraoperatively during laparoscopy [32]. Over the years, the use of laparoscopy in patients with complicated appendicitis has remained controversial, with the main arguments against it being the increased duration of the surgical procedure and the higher risk of postoperative infectious complications, particularly in children [59]. However, recent literature suggests that laparoscopic appendectomy can be an effective and safe method even in children with complicated appendicitis. It offers a lower rate of complications compared with the conventional open approach and may be considered the first therapeutic option for all patients, although additional prospective randomized studies are required to validate these conclusions [1].

Laparoscopic appendectomy has become the gold standard in the surgical treatment of appendicitis in children. The conventional procedure involves the use of three ports, one of which is inserted “open” through an infraumbilical incision and used for the introduction of the optical device. Pneumoperitoneum is achieved by CO_2 insufflation, maintaining the pressure between 10 and 12 mmHg. Under direct visualization, the other two operative trocars are inserted – one in the left flank and the other at the suprapubic level – providing access to the operative field [10].

Laparoscopic anatomy presents several particularities. The optical axis placed at the umbilical level initially determines visualization of the cecum, which may

obscure the appendix. To identify the base of the appendix, the anterior taenia coli is followed. Complete exposure of the appendix may require mobilization of the cecum and the omentum, as well as division of certain adhesions. Tilting the operating table to the left facilitates exposure of the appendix, while the mobility of the cecum is variable; in the case of a retrocecal appendix, division of the peritoneum in the right paracolic space may be necessary. The inflammation caused by acute appendicitis may alter anatomical landmarks and complicate the correct identification of the appendix [80].

After identifying the appendix and freeing it from the existing adhesions, resection of the appendiceal mesentery is performed, usually using bipolar forceps or a monopolar hook. The essential step of laparoscopic appendectomy consists of securing the base of the appendix, which is typically achieved using linear staplers, endoscopic loops, or polymer clips. More recently, clipless and sutureless appendectomy using a harmonic scalpel has been introduced. Each technique has its own specific advantages and disadvantages. The excised appendix is removed through the umbilical trocar, after which the abdominal cavity is carefully explored, any collections are evacuated, and in cases of gangrenous appendicitis with abundant purulent material, a tubular drain is placed through one of the 5-mm ports [10].

Laparoscopic appendectomies performed in children in complicated cases may be associated with intraoperative complications caused by technical difficulties during the dissection of a cecal appendix with advanced inflammation. In such situations, choosing the site where dissection begins is essential, because anatomical distortions and fibrosis may make the recognition of structures difficult, requiring the surgeon to start dissection in the least affected area. An alternative to the conventional antegrade laparoscopic technique in complicated cases is retrograde laparoscopic appendectomy, which involves initiating the dissection at the base of the appendix. This approach has proven to be technically feasible, allows optimal access to the appendix, and reduces the risk of excessive or unnecessary dissection in cases of complicated appendicitis [64].

However, there is significant variability between centers regarding the surgical approaches to appendicitis in children. In this context, some authors have proposed alternatives to the conventional three-port laparoscopic approach, such as single-incision laparoscopic appendectomy, which has become increasingly utilized due to its less invasive nature. Nevertheless, this technique has some disadvantages, including greater technical difficulty and longer operative times. In the literature, two main single-incision approaches for acute appendicitis in children have been described: the conventional technique, which involves intracorporeal management of the appendix, and laparoscopic-assisted transumbilical appendectomy with pneumoperitoneum, in which the appendix is exteriorized through the umbilicus for extracorporeal resection [86, 88, 62]. The laparoscopic-assisted transumbilical technique involves the insertion of an “open” trocar through an infraumbilical incision, followed by CO_2 insufflation to establish pneumoperitoneum. Systematic exploration of the abdominal cavity is performed using an operative laparoscope, and the appendix is grasped with an atraumatic laparoscopic instrument and pulled through the umbilical incision, together with the cecum if it is mobile. In the presence of adhesions between the appendix, cecum, and peritoneum, these are released using bipolar forceps or a monopolar hook. Appendiceal resection is then performed outside the abdominal cavity using conventional techniques: ligation of the appendicular vessels, ligation of the appendiceal stump base, excision of the appendix, and burying of the stump by creating a pouch. The cecum is then repositioned, and a subsequent laparoscopy allows evaluation of cecal integrity, potential bleeding, and the presence of any intra-abdominal contents. In situations where transumbilical laparoscopic-assisted appendectomy cannot be safely performed due to inadequate exposure or exteriorization through the umbilical incision – for example, in cases with unclear anatomy, adhesions, an inflamed appendiceal mass, or retrocecal/subserosal position – conversion to open appendectomy is recommended [10, 49].

Of particular interest is the laparoscopic-assisted transumbilical appendectomy without pneumoperitoneum in children, proposed by Yamaoka B. et al. (2025) [88]. This method may represent a safe alternative to conventional laparoscopic appendectomy; however, several aspects require further discussion. First, patients with perforated appendicitis and abscess formation were excluded from the study, which limits the scope of application, although the technique could be relevant in complicated cases where pneumoperitoneum presents increased risks for the patient. Another consideration relates to the reported operative times, which were significantly longer than those for conventional multiport laparoscopic appendectomy. The prolonged duration of surgery may raise concerns regarding surgical efficiency, anesthesia safety, and decision thresholds for conversion. Additionally, the interpretation of elevated inflammatory markers as predictors of conversion represents an important point that requires careful evaluation [37].

Efficient and safe closure of the appendiceal stump is an essential step for preventing serious postoperative complications [36]. One of the most important differences between laparoscopic and open appendectomy lies precisely in the method used to seal the appendiceal stump. This step is critical, and errors can lead to severe complications such as stump dehiscence, fistulas, peritonitis, and sepsis [48]. In traditional open appendectomy, either ligation and inversion of the stump into the cecum or ligation of the base without inversion is performed. In the technique with stump inversion, risks have been reported, including perforation of the cecal wall, abscess formation in the stump, and deformation of the Bauhin valve [77].

In laparoscopic appendectomy, there are multiple options for occluding the appendiceal stump. Although there is no unanimous consensus on the preferred method, several techniques have been successfully applied in practice without increasing the rate of intraoperative or postoperative complications [24]. All methods used for stump closure appear to provide a

similar level of safety. However, the degree of appendiceal inflammation and the surgeon's experience with laparoscopic technique influence the choice of the optimal method. Stump closure can be achieved using a manually tied loop, which has proven to be a safe and cost-effective method. Nevertheless, ligating the appendix can be technically challenging in children due to the limited working space available during laparoscopy [6, 89].

In cases of complicated acute appendicitis, particularly gangrenous or perforated forms, the appendiceal base may be morphopathologically compromised, making closure difficult and increasing the risk of serious complications such as appendiceal stump dehiscence, with subsequent fecal peritonitis or fistula formation. Inflammation and necrosis may extend to the surrounding cecal wall, preventing standard ligation. In such situations, several alternative options have been proposed, including placement of a cecostomy tube, partial cecal resection, or right hemicolectomy [90, 13].

Postoperative purulent intra-abdominal complications directly associated with the efficacy of appendiceal stump closure have been reported in 1.85–4% of cases, and necrosis of the appendiceal stump base was documented in 2.54% of cases [27, 71]. In laparoscopic procedures for complicated appendicitis with a compromised appendiceal base, some studies reported postoperative intra-abdominal abscess in 16.7%, ileus in 7.4%, and surgical site infection in 7.4%, while appendiceal stump fistula was observed in a single case [26].

In 1991, Cristalli B.G. and colleagues published the first report on the use of titanium clips in 20 patients, who were discharged on the fifth postoperative day without complications [16]. Titanium clips have proven to be safe and effective for securing the appendiceal base, offering advantages over stapling devices by providing the same biocompatibility at a comparatively lower cost [19, 81].

Several recent studies have shown that the rate of infectious complications is not significantly influenced by the method of appendiceal stump closure, whether using an endoloop or an endostapler. Routine closure with an endoloop is a safe, simple, and cost-effective procedure, even in cases of complicated appendicitis [95]. However, in perforated appendicitis, the use of an endostapler has been associated with a lower incidence of postoperative intra-abdominal abscess and postoperative ileus, as well as reduced rates of readmission and reoperation [25].

Meta-analyses suggest that appendiceal stump closure during laparoscopic appendectomy is feasible and safe with both endostapler and endoloop, even in complicated appendicitis. The use of an endostapler has been associated with a reduced incidence of superficial wound infection in children [14]. However, given the higher costs, the endostapler should be reserved for cases in which the stump cannot be safely secured with an endoloop or Hem-o-lok [24]. The use of non-absorbable polymer ligation systems, such as Hem-o-lok®, for securing the appendiceal stump offers several advantages, including simple application, wide availability, relatively low cost, and reduced operative time [41, 4]. However, Hem-o-lok clips are not recommended in cases of complicated appendicitis, such as perforation or inflammation of the appendiceal base, or when the appendiceal lumen is large, due to an increased risk of complications [74].

The use of Endo GIA for securing the appendiceal stump is limited by its high cost and the need for an additional port or replacement of the 10-mm suprapubic port to introduce the device. Additionally, the foreign materials used for stump fixation can trigger inflammatory reactions in the abdominal cavity, potentially leading to the development of adhesive intestinal obstruction [78, 92]. In recent years, several studies have reported on the effectiveness of sutureless appendectomy using devices such as the harmonic scalpel and the LigaSure™ bipolar coagulator [11]. Recent evaluations comparing the safety and efficacy of LigaSure™ versus Endoloop for appendiceal stump closure in pediatric laparoscopic appendectomy have shown that LigaSure™ is a safe and effective alternative, providing reliable sealing even in cases of complicated appendicitis [42].

The harmonic scalpel is also a safe and effective alternative for stump closure, offering improved surgical outcomes and faster recovery. Its use significantly reduces operative time, postoperative pain, complication rates, length of hospital stay, and the need for readmission, thereby improving postoperative recovery and outcomes [47]. A major advantage of these modern techniques is the elimination of complications associated with foreign bodies. The harmonic scalpel, powered by ultrasonic energy, can be used in both open and laparoscopic procedures for dissection, cutting, and sealing of tissues, serving as a versatile instrument that allows all these steps to be performed single-handedly.

Controversy persists regarding the usefulness of peritoneal drainage and irrigation, with recent literature, including Cochrane reviews and randomized studies, questioning the routine use of drains, particularly in uncomplicated appendicitis [44]. Peritoneal irrigation was first described in 1906 by Hotchkiss L.W., who noted: "Probably no issue in modern surgery is of greater interest and importance, and about which there is more disagreement, than the treatment of diffuse peritonitis. The absolute impossibility of draining the general peritoneal cavity does not seem evident enough to many surgeons, and the nature of the peritoneal response to drainage is only imperfectly understood." In cases of acute appendicitis, he proposed free irrigation of the pelvis and lower abdominal cavity with hot saline solution and placement of a small "cigarette-type" drain at the site of the removed appendix [33]. Over the years, this technique became widespread in abdominal surgery [65].

In appendectomy procedures, peritoneal irrigation aims to physically remove pus, necrotic tissue, fecal matter, and other infectious sources to reduce bacterial load and minimize the risk of postoperative intra-abdominal infections [45]. Some randomized studies have shown that superoxidized solution, used as an adjuvant therapy along with saline, can be safe and effective in reducing postoperative complications such as wound infection and pain, thereby contributing to faster recovery [73]. Additionally, some authors recommend peritoneal irrigation with antibiotics, superoxidized solutions, or specialized therapies such as intraperitoneal

chemotherapy and hyperthermic intraperitoneal chemotherapy, which have been shown to significantly reduce intra-abdominal infections and, in oncologic contexts, cancer cells when applied according to indications [31].

However, randomized clinical trials comparing wound irrigation with antibiotics versus irrigation with normal saline during open appendectomy have not demonstrated statistically significant benefits, indicating the need for further clinical validation [38, 72]. A recent study reported the local use of atomized povidone-iodine in small volumes as a new and feasible operative technique for laparoscopic appendectomy in complicated appendicitis in children [9].

Several studies have shown that peritoneal irrigation does not offer significant advantages compared with simple aspiration of peritoneal contents. In acute appendicitis, abdominal irrigation does not appear to reduce the incidence of intra-abdominal abscesses, leading to arguments in favor of avoiding routine peritoneal lavage in the treatment of perforated appendicitis in children. Nevertheless, there is a clear need for large-scale, multicenter randomized clinical trials to provide sufficient evidence for definitive conclusions. At present, the decision to perform peritoneal irrigation often depends on the surgeon's experience and is considered highly subjective [20, 61].

It is well known that children undergoing appendectomy for complicated appendicitis (gangrenous or perforated) have a higher predisposition to postoperative complications compared with those with uncomplicated appendicitis [57]. The placement of an intra-abdominal drain, both after open and laparoscopic appendectomy, has been considered beneficial for preventing postoperative intra-abdominal abscess formation, monitoring bleeding, and preventing appendiceal stump leaks. This practice was based on the widespread belief that the accumulation of inflammatory exudate in the abdominal cavity increases the risk of postoperative complications, including intra-abdominal abscesses, appendiceal stump leaks, wound infections, and intestinal obstructions [85].

However, the routine use of postoperative abdominal drainage remains controversial. Multiple sources of evidence, including Cochrane studies, suggest that routine drainage after various abdominal procedures is not essential [79]. The effect of drainage on preventing intra-abdominal abscesses or wound infection after open appendectomy is uncertain, and the degree of intra-abdominal contamination appears to play a more significant role in the development of complications [35, 3].

In laparoscopic appendectomy for patients with perforated appendicitis, some studies support that abdominal drain placement is safe and effective, and early removal within the first 48 hours is associated with lower postoperative complication rates, shorter hospital stays, and reduced costs [30]. However, other studies have shown that intraperitoneal drainage after laparoscopic appendectomy for complicated appendicitis does not provide additional benefits in preventing abscesses and may prolong hospitalization [57, 5].

There is also the view that pelvic drainage may provide real clinical benefits in selected cases, when the decision is guided by intraoperative findings and the surgeon's clinical judgment [7]. Consequently, high-quality clinical trials and prospective registries are needed to define the patient groups who might benefit from intraoperative drainage and to optimize practical protocols, including the type of drain, management method, and timing of removal [40].

Preoperative administration of antibiotics in uncomplicated appendicitis has demonstrated clear benefits, including reduced hospital stay and improved clinical outcomes. In addition, preoperative antibiotic therapy appears to slow disease progression, allowing safe postponement of surgery without increasing the risk of complications [76].

Postoperative antibiotic therapy is an additional option used to prevent postoperative infectious complications. The most common complications include intra-abdominal abscess, occurring in approximately 1.5–7.9% of patients after appendectomy, and surgical site infections, observed in 3.4–10.0% of cases. Evidence regarding postoperative antibiotic therapy is limited, and the optimal duration of treatment remains a matter of debate [83].

There is no consensus on the ideal duration of antibiotic therapy; most guidelines recommend treatment for 3 to 7 days. However, shorter courses may be equally effective in preventing infectious complications [66]. Decisions regarding the route of antibiotic administration should be individualized, taking into account patient characteristics, intraoperative findings, and the response to initial therapy [70].

Although the advantages of laparoscopy in pediatric surgery are well established, there is some discussion regarding the physiological effects of pneumoperitoneum, created by insufflation of CO_2 to establish working space in the peritoneal cavity. This can induce significant changes in respiratory and cardiovascular function, including decreased preload and cardiac output, alterations in heart rate and blood pressure, increased ventilation requirements, and reduced urine output, especially in infants. Other systemic effects include CO_2 absorption, stimulation of the neurohumoral vasoactive system, reduced renal blood flow, and impaired renal function [53].

Laparoscopic techniques have significantly reduced morbidity associated with appendectomy. Nevertheless, surgical treatment of appendicitis carries certain risks, including exposure to general anesthesia, wound infections, postoperative pain, accidental injury to intra-abdominal structures, and the possibility that these complications may occur in the context of a negative appendectomy. These considerations have fueled interest in non-operative management of uncomplicated acute appendicitis in children. Several recent studies have shown that this strategy can be a reasonable alternative, with one-year success rates of 70–85% [68].

However, some research has shown that in cases of uncomplicated appendicitis in children, non-operative treatment has significantly higher failure rates compared with surgical intervention, without substantial clinical benefits on secondary outcomes. These findings support surgery as the current treatment of choice [46].

Although laparoscopic appendectomy is considered the gold standard for acute appendicitis, conversion to an open procedure may be necessary in certain situations. Studies have identified six independent risk factors for conversion, including two preoperative factors – elevated white blood cell count and increased C-reactive protein levels – and four intraoperative factors – the presence of perforation, necrosis or gangrene, perityphlitic abscess, and peritonitis [8]. Reported conversion rates reach up to 19.8%, with common causes being dense adhesions, poor visualization, and intraoperative bleeding [67].

An emerging approach is endoscopic transcecal appendectomy, which is still in its preliminary stages. This technique has not been widely adopted due to the lack of guidelines on procedural protocols and patient selection. Its theoretical advantages include direct assessment of appendiceal orifice lesion extent, preservation of the ileocecal valve and adjacent colon, more direct access to the appendix, and reduced risk of injury to surrounding structures – particularly relevant in patients with prior abdominal surgery and adhesions. Additionally, this technique offers cosmetic benefits, avoiding surgical scars and incision-related complications such as hernias and wound infections [28, 55].

In conclusion, although acute appendicitis is a common and extensively studied condition, numerous uncertainties persist regarding the optimal diagnostic and therapeutic strategy. Controversies concern the indication for conservative versus surgical treatment, the timing of intervention in cases of phlegmon or appendiceal abscess, the need for postoperative antibiotic therapy, the role of drainage, the ideal technique for appendiceal stump closure, and the lack of standardized protocols for immunocompromised or neutropenic patients.

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КОМБИНИРОВАННЫЕ МЕТОДЫ НЕИНВАЗИВНОГО ОМОЛОЖЕНИЯ КОЖИ

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DOI: 10.5281/zenodo.19491294

Аннотация

Статья посвящена анализу современных неинвазивных и комбинированных методов омоложения кожи, применяемых в эстетической дерматологии. Рассматриваются биологические механизмы возрастных изменений кожи, включая снижение синтеза коллагена и эластина, нарушение структуры внеклеточного матрикса и ухудшение микроциркуляции. Представлен обзор современных неинвазивных технологий коррекции возрастных изменений кожи, таких как лазерные методы, интенсивный импульсный свет, радиочастотное воздействие, ультразвуковые технологии и фотобиомодуляция. Особое внимание уделено комбинированным протоколам омоложения, основанным на сочетании различных методов воздействия на кожу. Показано, что использование комплексных подходов позволяет воздействовать на несколько механизмов старения кожи одновременно и может повышать эффективность эстетических процедур. Рассмотрены также перспективные направления развития технологий омоложения кожи, включая персонализацию процедур, применение цифровых технологий анализа состояния кожи и расширение клинических исследований комбинированных методик.

Abstract

The article is devoted to the analysis of modern non-invasive and combined skin rejuvenation methods used in aesthetic dermatology. The biological mechanisms of age-related skin changes are considered, including decreased synthesis of collagen and elastin, disruption of the extracellular matrix structure and deterioration of microcirculation. An overview of modern non-invasive technologies for correcting age-related skin changes, such as laser methods, intense pulsed light, radio frequency exposure, ultrasound technologies, and photobiomodulation, is presented. Special attention is paid to combined rejuvenation protocols based on a combination of different skin treatments. It has been shown that the use of integrated approaches makes it possible to influence several mechanisms of skin aging simultaneously and can increase the effectiveness of aesthetic procedures. Promising areas for the development of skin rejuvenation technologies were also considered, including the personalization of procedures, the use of digital technologies for skin condition analysis and the expansion of clinical trials of combined techniques.

Ключевые слова: омоложение кожи, возрастные изменения кожи, неинвазивные методы, комбинированные технологии омоложения, лазерные технологии, радиочастотное воздействие, ультразвуковой лифтинг, фотобиомодуляция, эстетическая дерматология, фотостарение.

Keywords: skin rejuvenation, age-related skin changes, noninvasive methods, combined rejuvenation technologies, laser technologies, radiofrequency exposure, ultrasound lifting, photobiomodulation, aesthetic dermatology, photoaging.

Актуальность исследования

Возрастные изменения кожи являются естественным проявлением биологического старения организма и сопровождаются снижением синтеза коллагена и эластина, уменьшением упругости кожи, появлением морщин и нарушением пигментации. На состояние кожи также существенно влияют внешние факторы, в том числе ультрафиолетовое излучение, неблагоприятные экологические условия и особенности образа жизни. В связи с этим проблема профилактики и коррекции возрастных изменений кожи остается одной из актуальных задач современной дерматологии и эстетической медицины.

В последние годы наблюдается устойчивый рост интереса к неинвазивным методам омоложения кожи. Это связано с тем, что такие процедуры позволяют улучшить внешний вид кожи без хирургического вмешательства, характеризуются меньшей травматичностью и коротким периодом восстановления. Современная косметология располагает широким спектром технологий неинвазивного воздействия, включая лазерные, радиочастотные и ультразвуковые методы.

Вместе с тем процессы старения кожи имеют комплексный характер, поэтому применение отдельных методов не всегда обеспечивает выраженный и длительный результат. В связи с этим особое значение приобретает использование комбинированных протоколов омоложения, основанных на сочетании различных неинвазивных технологий. Исследование эффективности таких методов является актуальным направлением современной эстетической медицины.

Цель исследования

Целью данного исследования является анализ современных неинвазивных и комбинированных

технологий омоложения кожи, а также оценка их роли в коррекции возрастных изменений и повышении эффективности эстетических процедур.

Материалы и методы исследования

Материалами исследования послужили научные публикации, клинические исследования и обзорные статьи по дерматологии и эстетической медицине, посвященные проблемам старения кожи и современным методам ее коррекции.

В работе использованы методы анализа и обобщения научной литературы, сравнительный анализ различных неинвазивных технологий омоложения кожи, а также систематизация данных клинических исследований, посвященных применению комбинированных протоколов в эстетической дерматологии.

Результаты исследования

Кожа является крупнейшим органом человеческого организма и выполняет важные защитные, барьерные и регуляторные функции. Она состоит из нескольких основных слоев: эпидермиса, дермы и подкожно-жировой клетчатки. Эпидермис выполняет защитную функцию и участвует в процессах обновления клеток, дерма содержит коллагеновые и эластиновые волокна, обеспечивающие упругость и прочность кожи, а также сосуды, нервные окончания и фибробласты. С возрастом во всех слоях кожи происходят постепенные структурные и функциональные изменения, которые проявляются истончением тканей, снижением эластичности и появлением морщин. Исследования показывают, что при старении уменьшается толщина эпидермиса и дермы, нарушается структура дермоэпидермального соединения и снижается способность кожи к регенерации и заживлению повреждений.

Одним из ключевых факторов возрастных изменений кожи является снижение синтеза коллагена и эластина – белков, формирующих основу внеклеточного матрикса дермы. Коллаген обеспечивает прочность и механическую устойчивость кожи, тогда как эластин отвечает за ее упругость и способность восстанавливать форму после растяжения. С возрастом активность фибробластов снижается, что приводит к уменьшению выработки коллагена типов I и III, а также к разрушению эластических волокон. По данным научных исследований, синтез коллагена и эластина уменьшается примерно на один процент ежегодно, что постепенно приводит к дезорганизации соединительной ткани дермы и формированию морщин [4, с. 100].

Кроме уменьшения количества коллагена, возрастные изменения кожи сопровождаются изменением структуры внеклеточного матрикса. Коллагеновые волокна становятся фрагментированными и теряют упорядоченность, а эластиновая сеть постепенно разрушается. Это приводит к уменьшению толщины дермы и снижению ее механической прочности. Одновременно уменьшается количество фибробластов и сосудов, что ухудшает микроциркуляцию и снабжение тканей кислородом и питательными веществами. В результате кожа становится более сухой, менее эластичной и подверженной повреждениям.

Возрастные изменения кожи обусловлены как внутренними, так и внешними факторами. Внутреннее (хронологическое) старение связано с генетически обусловленными процессами клеточного старения, накоплением повреждений ДНК и снижением способности клеток к делению. Внешнее старение связано с воздействием факторов окружающей среды, среди которых наиболее значимым считается ультрафиолетовое излучение. Хроническое воздействие солнечной радиации вызывает фотостарение, характеризующееся появлением глубоких морщин, пигментных пятен и снижением упругости кожи. Эти изменения сопровождаются разрушением коллагеновых и эластиновых волокон, что усиливает процессы старения кожи [7, с. 95].

Основные морфологические изменения кожи при старении представлены в таблице 1.

Таблица 1

Основные морфологические изменения кожи при старении

Структура кожи	**Основные возрастные изменения**	**Последствия**
Эпидермис	Истончение слоя, снижение скорости обновления клеток	Повышенная сухость и чувствительность кожи
Дерма	Снижение количества коллагена и эластина	Появление морщин и снижение упругости
Фибробласты	Уменьшение активности клеток	Замедление синтеза коллагена
Сосудистая сеть	Уменьшение микроциркуляции	Ухудшение питания тканей
Внеклеточный матрикс	Дезорганизация коллагеновых волокон	Снижение прочности и плотности кожи

Источник: составлено автором на основе дерматологических исследований.

Наряду с морфологическими изменениями, старение кожи сопровождается нарушением ее физиологических функций. Уменьшается барьерная способность кожи, ухудшается иммунная защита и снижается способность тканей к восстановлению после повреждений. Исследования показывают, что возрастные изменения затрагивают также иммунные клетки кожи, меланоциты и клетки Лангерганса, что приводит к снижению защитных свойств и повышенной восприимчивости к инфекциям и внешним воздействиям. Структурные изменения кожи при старении представлены на рисунке ниже.

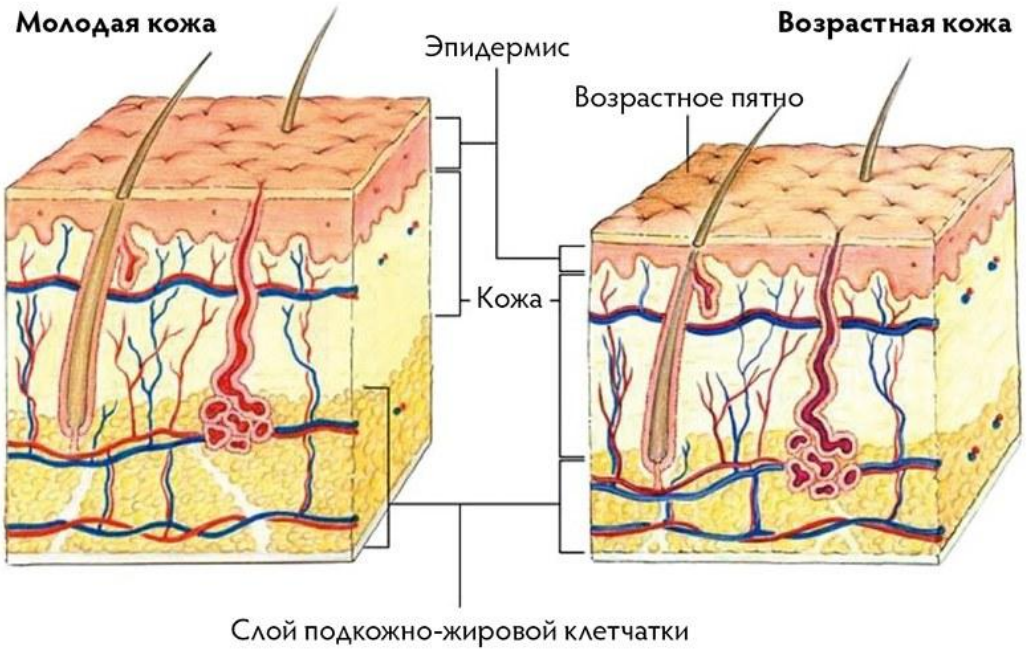

Рис. Структурные изменения кожи при старении [8]

Современные научные исследования показывают, что процессы старения кожи являются многофакторными и затрагивают различные структуры тканей. Понимание биологических механизмов старения кожи имеет важное значение для разработки эффективных методов коррекции возрастных изменений. В эстетической медицине используются различные подходы, направленные на стимуляцию синтеза коллагена, улучшение микроциркуляции и восстановление структуры дермы. К таким методам относятся лазерные технологии, радиочастотное воздействие, фототерапия и ультразвуковые методы. Их действие основано на контролируемом воздействии энергии на ткани, что запускает процессы регенерации и стимулирует образование новых коллагеновых волокон [6, с. 1240].

Современная эстетическая дерматология активно использует неинвазивные методы омоложения кожи, которые позволяют улучшить ее внешний вид без хирургического вмешательства и длительного периода восстановления. Такие технологии направлены на стимуляцию естественных процессов регенерации кожи, улучшение структуры дермы и повышение упругости тканей. В научной литературе отмечается, что неинвазивные методы применяются для коррекции морщин, пигментных нарушений, снижения тонуса кожи и признаков фотостарения [1, с. 75].

Одним из наиболее распространенных направлений являются световые технологии, к которым относятся лазерные методы и интенсивный импульсный свет (IPL). Принцип их действия основан на селективном фототермолизе – контролируемом воздействии световой энергии на определенные структуры кожи. В результате происходит стимуляция процессов обновления тканей и улучшение текстуры кожи. В клинических исследованиях отмечается, что системы IPL обычно работают в диапазоне примерно 500–1200 нм и используются для коррекции сосудистых и пигментных изменений кожи.

Другим широко применяемым методом является радиочастотное воздействие (RF-технологии). Данный метод основан на прогревании дермальных слоев кожи с помощью радиочастотной энергии. В научных обзорах указывается, что контролируемое нагревание тканей может стимулировать процессы ремоделирования дермы и приводить к улучшению упругости кожи. Эффект после процедуры развивается постепенно и может усиливаться в течение нескольких месяцев за счет формирования новых коллагеновых волокон.

В современной косметологии также применяются ультразвуковые технологии омоложения кожи. Микрофокусированный ультразвук позволяет воздействовать на более глубокие структуры кожи без повреждения поверхностных слоев. В систематических обзорах отмечается, что данный метод используется для коррекции возрастных изменений, связанных с потерей тонуса кожи, и может приводить к постепенному улучшению ее плотности и эластичности.

К числу неинвазивных методов также относят фотобиомодуляцию с использованием светодиодных источников (LED-терапию). В научных публикациях рассматриваются различные длины волн, включая 633 и 830 нм, которые применяются для стимуляции клеточной активности и улучшения состояния кожи. LED-терапия характеризуется высокой переносимостью и обычно используется курсами процедур [2, с. 621].

Помимо аппаратных технологий, важную роль в коррекции возрастных изменений кожи играют дерматологические средства наружного применения. Наиболее изученными являются топические ретиноиды, включая третиноин, эффективность которого при фотостарении подтверждена клиниче-

скими исследованиями. В дерматологической практике также применяются поверхностные химические пилинги на основе альфа-гидроксикислот, в частности гликолевой кислоты, которые способствуют обновлению эпидермиса и улучшению текстуры кожи.

Примеры параметров и источников для неинвазивных технологий омоложения описаны в таблице 2.

Таблица 2

Примеры параметров и источников для неинвазивных технологий омоложения

Технология	**Тип воздействия / параметр**	**Основные характеристики**
IPL (интенсивный импульсный свет)	Спектр 500-1200 нм	Световое воздействие на хромофоры кожи, применяется для коррекции сосудистых и пигментных изменений
Микрофокусированный ультразвук	Воздействие на глубокие слои дермы	Стимуляция ремоделирования тканей без повреждения эпидермиса
Радиочастотное воздействие (RF)	Прогрев дермы радиочастотной энергией	Стимуляция синтеза коллагена и улучшение упругости кожи
LED-фототерапия	Длины волн 633 нм и 830 нм	Фотобиомодуляция, стимуляция клеточной активности
Неаблятивный фракционный лазер	Длина волны около 1550 нм	Улучшение текстуры кожи и стимуляция процессов обновления
Топический третиноин	Наружный ретиноид	Клинически подтвержденное средство для коррекции признаков фотостарения

Источник: разработка автора по данным открытых публикаций.

В современной эстетической дерматологии комбинированные протоколы омоложения кожи рассматриваются как одно из наиболее перспективных направлений коррекции возрастных изменений. Это связано с тем, что процессы старения кожи имеют многофакторный характер и затрагивают различные структуры кожного покрова: эпидермис, дерму, сосудистую сеть и внеклеточный матрикс. В связи с этим применение одного метода не всегда позволяет воздействовать на все механизмы старения, тогда как сочетание различных технологий дает возможность комплексно улучшить состояние кожи.

В научной литературе комбинированные протоколы описываются как последовательное или одновременное применение различных неинвазивных методов в рамках одной терапевтической программы. На практике часто используются сочетания аппаратных технологий, которые воздействуют на ткани кожи на разных уровнях. Например, сочетание световых методов и радиочастотного воздействия позволяет одновременно влиять на пигментацию, сосудистые изменения и упругость кожи. В исследованиях отмечается, что подобные комбинации могут повышать эффективность процедур и улучшать клинический результат.

Одним из известных примеров комбинированных технологий является метод электрооптической синергии (ELOS), который объединяет световое воздействие и радиочастотную энергию. В клинических исследованиях данный подход рассматривается как неаблятивная технология омоложения, при которой совместное применение двух видов энергии позволяет достигать выраженного эффекта при использовании более низких уровней воздействия каждого из компонентов. В публикациях отмечается улучшение текстуры кожи, уменьшение выраженности морщин и повышение ее плотности [5, с. 185].

Комбинированные протоколы могут включать также последовательное применение различных аппаратных процедур, например радиочастотного воздействия и ультразвуковых технологий. Эти методы имеют разные механизмы действия и различную глубину проникновения энергии в ткани, что позволяет воздействовать на несколько уровней кожного покрова. В клинических наблюдениях сообщается о положительной динамике состояния кожи после проведения курса процедур, включающего несколько технологий.

В ряде клинических исследований также анализируется сочетание лазерных методов омоложения с другими технологиями. В систематических обзорах отмечается, что комбинированные лазерные протоколы могут демонстрировать более выраженные результаты по сравнению с использованием одного метода. При этом подчеркивается необходимость индивидуального подбора процедур с учетом типа кожи пациента, степени выраженности возрастных изменений и возможных рисков нежелательных реакций [3, с. 148].

Перспективы развития комбинированных технологий омоложения кожи в современной дерматологии и эстетической медицине в первую очередь связаны с повышением точности диагностики и персонализацией протоколов. В открытых обзорах по применению искусственного интеллекта в эстетической медицине и дерматологии отмечается рост роли цифрового анализа изображений, прогнозирования результата и поддержки принятия решений при планировании процедур. Это означает, что

комбинированные схемы все чаще будут подбираться не «по шаблону», а с учетом объективных параметров кожи и динамики изменений.

Еще одно направление связано с развитием неинвазивной визуализации кожи для контроля эффективности и безопасности курсов омоложения. В публикациях по неинвазивной оптической визуализации подчеркивается клиническая ценность методов, позволяющих оценивать структуры кожи in vivo (например, оптическая когерентная томография и другие методы), что расширяет возможности объективного мониторинга до и после процедур. Параллельно расширяется доказательная база конкретных сочетаний технологий: в клинических работах описываются комбинации, демонстрирующие более выраженные изменения по нескольким показателям качества кожи в одной программе лечения.

Выводы

Таким образом, возрастные изменения кожи являются сложным многофакторным процессом, затрагивающим различные структуры кожного покрова. Современные неинвазивные технологии омоложения позволяют улучшать состояние кожи за счет стимуляции процессов регенерации и ремоделирования дермы. Наиболее перспективным направлением в эстетической дерматологии является применение комбинированных протоколов, основанных на сочетании различных аппаратных и дерматологических методов. Использование комплексных подходов позволяет воздействовать на несколько механизмов старения кожи одновременно и может обеспечивать более выраженный клинический результат. Дальнейшее развитие технологий омоложения связано с персонализацией процедур, совершенствованием методов диагностики кожи и расширением клинических исследований эффективности комбинированных методик.

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PEDAGOGICAL SCIENCES

DIDACTIC CLASSIFICATION OF TOURIST TERMS AND THEIR LEXICAL AND SEMANTIC CHARACTERISTICS

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DOI: 10.5281/zenodo.19491309

Abstract
The article provides a didactic classification of tourist terms for their systematic study and defines their lexical and semantic characteristics. The study shows that tourism terminology is closely related to the international lexicon and has a variety of semantic nuances. The classification of terms by origin, formation of synonymous series, metaphorical and metonymic extension, as well as their functionality in a professional communicative environment is justified from a linguistic point of view. As a result of the article, a scientific and theoretical basis has been formed for the application of modern didactic models in teaching tourism terminology.
Keywords: tourism terms, terminology, didactic classification, lexical features, semantic features.

Tourism, as one of the most dynamically developing areas of global economic, social and cultural life of the 21st century, is not only a separate sector of the economy, but also a complex system combining various professional fields of activity, creating a broad communication platform. The terminology developed in this field forms a professional lexical background that accurately reflects the basic concepts, processes, types of services, management mechanisms, etc. of the tourism industry. The structural and semantic features of tourism terminology are of great importance not only from a linguistic point of view, but also in its teaching and proper use in a professional communication environment.

In the modern era, the expansion of educational programs in the field of tourism, the increase in personnel training in this field and the deepening of international cooperation necessitate the systematic study of tourist vocabulary from a didactic point of view. The correct classification of terms, the characterization of their semantic shades and the definition of methods applicable in the educational process create conditions for more effective training of specialists [1].

The terminology of tourism is characterized as a multi-source lexical system: international terms, borrowings from English, regional names of tourist places and professional vocabulary related to various fields of services are the main layers that make up this system. This diversity requires the use of various didactic approaches, depending on the origin of terms, their structural and formative properties and semantic areas of development.

On the other hand, the semantic properties of tourist terms — polysemy, transposition, metaphorical extension, functional variability — require special attention when forming the professional linguistic competence of specialists working in this field. The functionality of terms both in the language system and in the educational environment makes their didactic classification an urgent scientific problem. The purpose of this article is to conduct a didactic classification of tourist terms, to determine the lexical and semantic properties of the terms, as well as to substantiate scientific and methodological principles that can be applied in their teaching. The scientific novelty of the research lies in the analysis of tourist terms based on an integrated approach combining linguistic and didactic aspects [4].

The didactic classification of tourism terminology is a scientific and methodological approach that makes it possible to master these terms more systematically, purposefully and gradually in the educational process. The didactic classification is based not only on the formal, structural and semantic properties of terms, but also on the methods of teaching them, the contexts of practical application, functionality in professional fields and grouping according to the level of understanding of students. This approach, by systematizing the multifaceted and complex nature of tourism terminology within the didactic model, creates conditions for a balanced application of both theoretical and practical directions in the educational process.

The first main criterion of didactic classification is the principle of content orientation. This principle is based on the content load of terms, the thematic area to be mastered, and the functional content of the concepts they express, taking into account the multilevel structure of the tourism sector. From this point of view, tourist terms are grouped into several subgroups: terms related to types of tourism activities (ecotourism, rural tourism, cultural tourism, etc.); Terms related to tourism services and infrastructure (booking, registration, transfer, hospitality, tour operator, etc.); hotel and restaurant business terms (standard room, accommodation, reception, concierge, etc.); terms related to navigation and logistics (route, itinerary, destination, excursion, etc. This classification helps to maintain consistency of topics in the learning process, provides a clearer understanding of the meaningful relationships of terms and a gradual familiarization of students with the system of professional terminology [2; 5].

The second criterion is classification according to the principle of the origin of terms. Within the framework of this classification, terms are divided into three main groups: terms formed in their native language,

borrowed from different languages, and international terms. The predominance of international terminology in the field of tourism makes the study of this criterion especially important, since, knowing the etymological foundations of the terms, students more easily perceive their semantic nuances and the possibilities of functional application. The process of phonetic adaptation, morphological integration and semantic adaptation in the assimilation and teaching of international terms requires a special explanation, which is a matter requiring a separate methodological approach from a didactic point of view [7].

The third criterion is the functional and applied classification. According to this criterion, terms are grouped according to their role in real-world communication situations, interdisciplinary interactions, and the requirements of professional practice. This classification provides the study of terms in a functional context for the service sector, management, marketing and advertising, interaction with tourists, preparation of travel packages, hotel reservations and other stages of service. This approach helps students not only memorize terms, but also master their actual use, and has a significant impact on the formation of professional language competence [3].

One of the most important stages of didactic classification is the grouping of terms by degree of complexity. This grouping allows you to form a step-by-step course structure, implement step-by-step learning and apply a differentiated approach to the study of terms. Identifying simple, medium, and complex terms makes it easier for students to understand terms and build learning materials more effectively. At the same time, classification by degree of complexity makes the learning process more focused, taking into account the semantic multiplicity of terms, contextual dependence and the level of knowledge necessary for practical application. Thus, didactic classification is not only a mechanism for grouping terms, but also a comprehensive pedagogical approach that enriches the scientific and methodological foundations of training specialists in the field of tourism [6; 8].

Lexical characteristics of tourism terms:

The lexical characteristics of tourism terms are one of the main indicators of the multilevel structure of terminology. The lexical system of this field is fueled by various sources and is formed at the junction of common language vocabulary and international terminology. At the lexical level, the most striking feature is the widespread use of terms borrowed from English. As a result of the fact that the main standards of the global tourism industry are based on English, terms such as *“booking”, “check-in”, “amenities”, “full board”, “airport shuttle”, “tour package”* are consistently used in the tourist vocabulary of almost all languages. The integration of these borrowings into the language is accompanied by phonetic, morphological suffixation and semantic adaptation processes, which indicates the dynamic development of the lexical system.

It should also be noted that the tourist vocabulary is dominated by wordy phrases. Structures such as “five-star hotel”, “standard double room”, “domestic tourism”, “cultural heritage site”, “airport transfer service” play an important role in the terminological system, as they more accurately express complex concepts. Such combinations can create certain difficulties for students from both semantic and syntactic points of view. For this reason, contextual explanation, the use of visual materials and the analysis of real examples of communication are important didactic methods in their teaching.

One of the lexical features is that a number of words and expressions used in everyday speech acquire terminological significance in the field of tourism. For example, while the word “season” usually means a season, in tourism it refers to specific economic and service periods such as high season, low season, and off-season. Similarly, words such as “package”, “service”, “comfort”, “luxury”, “budget” have specific semantic connotations in the travel industry. These processes indicate that transposition and terminological mechanisms are widely used in the lexical development of terms.

Synonyms are also often found in travel terminology. The expression of the same concept in several terms in different countries and different travel companies *(“travel agent” – “tour consultant”, “guide” – “tour leader”, “excursion” – “city tour”)* creates a terminological parallelism in the lexical system. In the educational process, synonymy increases the flexibility of students' understanding, allows them to realize the differences that arise when expressing the same meaning in different terms, and forms the ability to adapt in professional communication.

Another important aspect of the structural features of the tourist vocabulary is the stabilization of metaphorical and metonymic vocabulary in terminology. Expressions such as *“golden season”, “peak period”, “dead season”, “green tourism”, “blue tour”* have moved away from their original figurative meanings and have become terms denoting specific economic and environmental concepts. This demonstrates the semantic flexibility of the terminological system and the breadth of lexical creativity. All these features prove that the tourist vocabulary is a multifaceted and dynamic system in terms of meaning, structure and functionality. Therefore, from a pedagogical point of view, a separate explanation of each of the lexical features, an analysis of their semantic and functional shades, as well as their application to various textual and situational examples are of particular importance. A deep understanding of the lexical structure of travel terms teaches students not only to memorize words, but also to use them correctly, purposefully and in accordance with the context in a professional communicative environment.

Semantic features of tourist terms:

The semantic features of tourist terms reflect the multilevel semantic mechanism of the terminological system of this area, its contextual variability and the special shades of meanings that it acquires in a specialized language environment. The formation of semantics in the tourist lexicon is connected both with the terminologization of words existing in the common language and with the acquisition of new semantic functions by terms borrowed from international standards. In this regard, tourist terms are not limited to ex-

pressing only one meaning, but often carry different semantic loads in different contexts, and this feature makes their teaching more difficult, but no less interesting.

One of the main areas of semantic features is the polysemy of terms. For example, the term “package” may refer to both a set of services, a specific type of travel product, and a model for evaluating a travel package. The term “season”, in contrast to the commonly used linguistic context, refers to the time stages of tourism intensity. This method of ambiguity teaches students to understand not only the lexical content of terms, but also their situational use.

Metaphorical and metonymic extensions occupy a special place in the semantic system of tourist terminology. Expressions such as “*high season”, “dead season”, “peak period”, “golden tour”, “green tourism”*, despite their initial metaphorical origin, have already become stable semantic signs in the terminological system. Since these terms define the economic, environmental, and socio-cultural characteristics of the tourism process, the metaphorical origin acquires semantic certainty and serves as a terminological definition.

Another important aspect in the semantic field of tourist terms is the contextual dependence of meaning. Terms such as *“service”, “standard”, “comfort”, “luxury”, “budget”, “facility”* can acquire different semantic shades depending on the environment in which they are used. For example, "comfort" may refer to the comfort of a certain type of hotel room, the level of airline tickets, and the number of additional services in travel packages. For this reason, semantic analysis requires a contextual approach in the learning process and develops students' ability to choose the meaning appropriate to the situation.

Transposition plays an important role in the formation of semantic structure in tourism terminology. Words such as *“Guide”, “route”, “trip”, “transfer”, “booking”,* went beyond their original ordinary meaning and began to carry specialized semantic functions in the system of professional terminology. This process indicates the semantic development of the language, as well as the lively and action-oriented nature of terminology.

Another direction in the development of semantic features is antonomasia and the transformation of proper names into terms. For example, the terminological meaning of the word “Maldives” as luxury maritime tourism, “Dubai” as shopping and high-end tourism, and “Alps” as a winter tourism brand is the result of a semantic nomination process. The terminological meaning of geographical names expands the concept of a brand in the field of tourism and increases the cultural and semantic load of terms.

The semantic features of tourist terms also reflect the existence of synonymous and antonymic relations in the terminological system. Semantic oppositions such as *“tourist”–“traveler”, “guide”–“tour leader”, “luxury”–“budget”*, help to more accurately understand the meaning of terms and perceive their intra-system relationships. These relationships play an important role in building a terminological network and allow the use of semantic grouping methods in the learning process.

As a result, the semantic features of tourist terms demonstrate the multidimensional semantic structure of the terminological system in this area, its contextual variability, cultural and functional significance, as well as the dynamic development of the language. Each of these features requires a special methodological approach to teaching terms and is of great importance in the formation of students' professional language skills.

Mastering the terms in the learning process:

Mastering the terms in the learning process is a key stage in the formation of students' professional lexical skills in the field of tourism education. Effective mastering of terms is not limited to studying their lexical and structural features, but also includes their application in real-world practice, communicative situations and professional contexts. In this regard, the learning process is carried out in two main directions: lexical and semantic development and functional and practical use [9].

At the lexico-semantic stage, students analyze the origin of terms, lexical structure, morphological and semantic features, synonymy and antonymic relations. Examples of the use of terms in context, visual and textual materials, as well as their connection with real situations in the tourism industry contribute to the understanding of semantic connections and the assimilation of terms within the framework of the content. At the same time, teaching students verbose combinations of terms, metaphorical and metonymic expressions, as well as contextual meaning develops semantic flexibility.

At the functional and practical stage, the use of terms is adapted to real tourism activities. This includes role-playing games, situational models, preparation of travel packages, modeling of hotel reservations, dialogues with tourists, training in guide activities and the service process. These methods develop students' ability not only to memorize terms, but also to use them situationally and purposefully. The practical approach emphasizes the functional aspects of the terms, enhances students' professional communication and decision-making skills.

The use of modern pedagogical technologies makes the assimilation of terms more effective and visual. These methods clearly demonstrate the structural and semantic features of terms, increase the level of students' perception and make the learning process interactive and interesting.

Thus, the development of terms in the educational process should be based on the integration of didactic and practical aspects, a gradual and systematic approach, as well as the possibility of application in accordance with real professional activities, and should form the professional terminological competence of students in the field of tourism. This approach provides both a deeper understanding of the terms and the development of professional language skills, as well as improves the quality of tourism education.

Conclusion. The analysis shows that the classification of tourist terms from a didactic point of view forms an important scientific and methodological basis for the systematic teaching of terminological knowledge in this field. The creation of a didactic classification based on criteria such as content orientation,

origin-principle, functional-applied orientation and degree of complexity creates conditions for the comprehensive development of both linguistic and professional aspects of terms. These criteria open up wide opportunities for students to apply terms not only at the level of explanation, but also in real-world communication situations, as well as for mastering professional vocabulary in various sub-sectors of the tourism industry [10].

Conclusion. The study shows that the high proportion of international terminology in the field of tourism makes didactic classification even more necessary and ensures the correct use of terms in multilingual communication. Grouping terms by origin, functional structure, and level of complexity increases the gradualness, consistency, and effectiveness of the educational process, and contributes to the formation and strengthening of students' professional vocabulary. Thus, the didactic classification of tourism terms can be assessed as a scientific and methodological approach that remains relevant both pedagogically, linguistically and professionally, creating a methodological basis for tourism education and strengthening the professional competencies of students.

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THE USE OF ARTIFICIAL INTELLIGENCE IN DEVELOPING FOREIGN LANGUAGE COMMUNICATION SKILLS IN FUTURE SPORTS PROFESSIONALS: BENEFITS AND HARMS

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Abstract
In the context of globalization and active international interaction in the sports field, proficiency in foreign languages is becoming a crucial professional competency for future specialists. Modern artificial intelligence (AI) technologies are increasingly being integrated into the educational process and used to develop communication skills in foreign languages. This article examines the potential of AI in teaching foreign languages to students majoring in sports and analyzes the benefits and potential risks of using these technologies. Particular attention is paid to the impact of AI on the development of oral communication, professional vocabulary, and intercultural competence.
Keywords: artificial intelligence, foreign languages, communication skills, sports education, digital technologies, professional training.

The globalization and internationalization of professional activity in sports place new demands on the training of future specialists. Modern coaches, sports managers, rehabilitation therapists, and physical education teachers are increasingly engaging in international professional communication: participating in international competitions, conferences, internships, and working in multicultural teams. Therefore, proficiency in a foreign language and developed intercultural communication skills are becoming essential components of a sports specialist's professional competence.

Virtual reality, which has become widespread in recent years, was initially used in the gaming industry and then expanded to other fields. Although it is not yet used in education in Azerbaijan, its use has already begun in some countries. Despite the familiarity of teachers and students with the virtual world, its use has not yet become widespread.

In recent years, the use of artificial intelligence (AI) in the educational process, including in foreign language teaching, has attracted particular attention from researchers. Intelligent teaching systems, chatbots, voice assistants, and automated speech and text analysis platforms offer new opportunities for developing students' communicative skills. However, the active implementation of AI in language education is sparking debates related to pedagogical, ethical, and social risks [3].

The purpose of this article is to analyze the advantages and disadvantages of using artificial intelligence in developing foreign language communication skills in future sports professionals, drawing on the work of European and Russian researchers.

Technology is changing the learning process. Advanced technologies offer a number of advantages for teacher education and student language instruction.

The concept of artificial intelligence in an educational context is defined as a set of digital technologies capable of simulating human cognitive processes: learning, analysis, decision-making, and speech generation. European researchers (S. Narciss, I. Goldin, C. Gardent, and others) emphasize that the key value of AI lies not in replacing teachers, but in expanding the teaching toolkit.

The use of modern technology in foreign language teaching is becoming indispensable, especially in light of unprecedented developments in many fields and subjects. It is essential to optimize foreign language teaching and ensure that teachers do not miss out on the global technological revolution by integrating modern technological tools into the education sector, such as computers, multimedia devices, mobile phones, audiovisual applications, and social media.

AI in foreign language teaching draws on advances in computational linguistics, natural language processing (NLP), and machine learning. These technologies make it possible to analyze students' oral and written speech, identify common errors, adapt tasks to their language proficiency level, and create individualized learning paths.

The internet provides easy, instant, and virtually unlimited access to a wide range of software, applications, support platforms, and materials that can accelerate the teaching and learning of English. Context-based learning is particularly important for future sports professionals. AI can simulate professional communication situations, such as interviewing athletes, discussing training plans, and communicating with international referees and medical personnel.

One of the key advantages of AI is the ability to personalize the learning process. Intelligent platforms adapt the difficulty of assignments, the pace of learning, and the content of materials to the student's level of preparation. According to European researchers, individualization promotes increased motivation and autonomy in learners, which is especially relevant for students in sports fields who combine their studies with intensive training.

“On the basis of this analysis of the learning/teaching situation, it is seen as fundamentally important to define, clearly and explicitly, objectives which are at once worthwhile in terms of learner needs and realistic in terms of their characteristics and resources” [10, p.5].

While experts believe that the psychology of human learning has not changed much over time, the external factors that influence our understanding, memorization, and absorption of new material are constantly evolving [3].

The use of artificial intelligence in developing foreign language communication skills allows for a more personalized and flexible learning process. The AI is capable of adapting to each learner's language proficiency, taking into account their individual difficulties and learning pace, and offering tasks aimed at developing specific communication skills. This allows students to create their own learning path and more effectively develop speaking, listening, reading, and writing skills [6].

Learning a foreign language for communicative purposes requires developing verbal skills and the ability to work with new technologies. During the language learning process, students learn to communicate in German through a variety of activities.

“AI tools have become increasingly popular in recent years as a means of helping students improve their language skills. AI-powered language learning platforms offer a range of features designed to improve language skills. One of the main advantages of these tools is that they provide students with the opportunity to practice speaking and listening with native speakers or virtual interlocutors, which in turn allows them to improve pronunciation, intonation and fluency in a supportive environment with minimal stress” [9, p.46].

Chatbots and voice-based AI systems allow for the simulation of dialogue situations that closely resemble real-life interactions. Students can practice spontaneous speech skills, responding to others' comments, and using professional vocabulary. This is especially important for preparing for international competitions and professional contacts.

According to systems theory, the control actuator that carries out the control actions, the controlled variables, and a sensor that measures the controlled variable are key elements of the controlled process. To regulate the controlled process, the controller requires the reference value, the actual value provided by feedback, and comparison and transformation procedures for generating the control actions [2, p.128].

Online learning, one of the latest technologies used in modern higher education, is part of a general development. This process is aimed at simplifying the user experience and facilitating the assimilation of information.

AI provides instant feedback, identifying phonetic, grammatical, and lexical errors. According to research by S. Narciss and I. Goldin, timely formative feedback promotes deeper acquisition of language material and the development of reflective skills [2, p. 128].

Effective use of online resources is not limited to technical support. Methodological approaches, the digital competence of the teacher, student motivation, and the appropriateness of the selected materials all play a significant role. Scientific literature and practical experience show that properly selected and purposefully used online resources not only develop students’ language skills but also enhance their intercultural communication skills [12]. AI platforms can be configured to work with highly specialized vocabulary, including sports terminology, which enhances the practical focus of learning. This fosters professionally oriented foreign language communicative competence.

Influenced by technological advances, pedagogical technologies are gaining new opportunities to influence the traditional learning process and improve its effectiveness.

Currently, the role and use of technology as a tool for teaching English is increasing, as teachers have realized their ability to create both independent and collaborative learning environments in which students can easily learn English. The use of ICT in the teaching process requires time, and teachers are expected to be innovative and enthusiastic about ICT-based teaching [11].

Despite AI's technological capabilities, it cannot fully replace live communication with native speakers. Excessive use of automated systems can lead to the formation of artificial, formulaic language and a decrease in the emotional component of communication.

Learning technologies are a specific teaching method in which the primary force in implementing learning functions is exerted by a human-controlled learning tool. The development of highly effective learning technologies, on the one hand, improves the effectiveness of educational materials, and on the other, allows teachers to devote more attention to the individual and personal development of students and guide their creative development.

European researchers emphasize that AI has difficulty conveying cultural and pragmatic aspects of communication: humor, non-verbal cues, and sociocultural norms. For sports professionals working in an international environment, this is a significant limitation [4; 5; 6].

Information and communication technologies used in education are rapidly and actively being implemented in educational institutions in our country. The nature of activities carried out using such media technologies is characterized by an intensive communicative process of knowledge exchange, increased motivation for self-improvement and acquisition of new knowledge, and increased individual responsibility in collective activities. The use of AI raises issues of personal data protection, copyright, and algorithmic transparency. In the educational environment, this requires the development of regulatory and methodological guidelines governing the use of intelligent systems.

All of this can be achieved through the appropriate and targeted use of ICT and authentic materials. Teaching a foreign language using interactive methods is a process that takes into account the capabilities and needs of each student, as well as students with varying levels of proficiency.

Automation of language support can lead to a decrease in learners' independence and their dependence on AI prompts, which negatively impacts the development of critical thinking and linguistic intuition.

“The eight papers in this issue demonstrate a wide range of research on feedback, spanning a variety of feedback strategies, instructional domains, AI techniques, and educational use cases” [1, p.15].

Most European educators agree that AI should be viewed as a supporting tool. The teacher remains a key figure, providing methodological support, interpreting

errors, developing intercultural competence, and shaping the value orientations of future sports professionals [7; 8; 9].

With the digitalization of language education, the role of the teacher is undergoing significant changes, but it remains crucial. Teachers are no longer the sole source of knowledge and are increasingly acting as organizers and moderators of the educational process, guiding students in their work with digital resources and technologies. They help select high-quality materials, formulate learning objectives, and build a logical learning structure, ensuring the pedagogical appropriateness of the use of digital tools.

The optimal learning model is a blended format that combines traditional teaching methods and the capabilities of AI. Computer technologies enable the practical application of psychological and pedagogical developments that facilitate the transition from mechanical acquisition of knowledge to the ability to independently assimilate new knowledge, and develop the information literacy of future specialists [4].

The use of artificial intelligence in the training of sports specialists opens up vast prospects for improving the quality of professional education. AI enables the analysis of large volumes of data on the training process, athletes' physical condition, and competition results, facilitating more accurate training planning and the development of professional competencies in future coaches, sports managers, and analysts. This makes training more practice-oriented and closer to the real-life conditions of professional work.

The appropriate use of ICT in foreign language teaching not only improves the effectiveness of the learning process but also increases student interest in acquiring new knowledge and learning, making them more engaged and facilitating teacher preparation for the lesson. While students previously obtained information on subjects and topics from textbooks, textbooks, and television programs, these are now being replaced by the internet, e-books, and so on.

The use of artificial intelligence in developing foreign language communication skills in future sports professionals offers significant educational potential. AI facilitates the individualization of learning, the development of oral communication, and the professionalization of language training. However, its use is associated with a number of risks related to limited cultural context, ethical considerations, and the potential loss of face-to-face communication [7].

The effective implementation of AI is only possible with pedagogical support and a judicious combination of digital and traditional teaching methods.

Supporting students' individual educational trajectories is becoming an important task for teachers. Using digital platforms and artificial intelligence, teachers analyze learning outcomes, identify difficulties, and provide targeted support in developing language skills. At the same time, teachers ensure the development of communicative and sociocultural competence, creating conditions for meaningful communication, critical thinking, and reflection, which cannot be fully automated by digital technologies [5].

Developing all components of communicative competence is a key goal in learning foreign languages. Communicative competence encompasses not only knowledge of grammar and vocabulary but also the ability to effectively use language in real-life situations, which requires the integration of various aspects: lexical and grammatical, sociocultural, pragmatic, and strategic competence.

Lexical and grammatical competence is the foundation of language: knowledge of grammatical rules, structures, and vocabulary necessary for correct and meaningful communication. However, this is not enough to communicate effectively. An important aspect is sociocultural competence, which helps learners understand and consider cultural differences, communicative norms, and social contexts. This is especially important in international communication, where understanding cultural specifics helps avoid misunderstandings and facilitates deeper interaction [2].

Pragmatic competence is the ability to use language appropriately for the goals, objectives, and context of communication. It includes understanding which statements are appropriate in a given situation and how to structure a dialogue to achieve the desired result. Developing pragmatic competence is impossible without strategic competence, which helps overcome communicative difficulties, such as unfamiliarity with a word or expression. Strategic competence includes the skills of paraphrasing, clarifying, compensating, and finding alternative ways to maintain communication.

To effectively develop all components of communicative competence, it is important to apply a comprehensive approach, using a variety of teaching materials and methods that encourage active and multifaceted use of language. It is also important to consider the role of feedback, practice in real-life situations, and regular reflection to optimize language acquisition.

Furthermore, in the context of digitalization, the role of teachers as mentors and holders of professional and value orientations is growing. They develop students' skills for the responsible and ethical use of digital resources, develop motivation for language learning, and maintain an emotionally supportive learning environment. Thus, teachers become the link between technology and the student's personality, ensuring a harmonious blend of digital capabilities and the humanistic principles of language education.

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INTEGRATING ARTIFICIAL INTELLIGENCE IN ENGLISH LANGUAGE INSTRUCTION: AN ACADEMIC PERSPECTIVE

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DOI: 10.5281/zenodo.19491328

Abstract

The integration of Artificial Intelligence (AI) into the educational process represents a significant direction in the development of modern pedagogy. This study examines the effectiveness of using AI-based tools, particularly Chat GPT, in teaching English as a foreign language at the upper-secondary school level. The purpose of the research is to determine the impact of AI-assisted instruction on students' language proficiency and academic achievement. The study was conducted during February–March 2026 and involved 18 eleventh-grade students.

A quasi-experimental research design was applied, including pre-testing, systematic use of ChatGPT for grammar, vocabulary, and writing practice, and post-testing. Students' learning outcomes were assessed using a five-point grading scale, along with indicators of average performance and quality of knowledge.

The results indicate a positive influence of AI integration on students' academic performance. The average score increased from 3.45 to 3.92, while the quality of knowledge rose from 57% to 73%. The findings suggest that AI tools support individualized learning, provide immediate feedback, and enhance students' motivation. The study concludes that Artificial Intelligence serves as an effective supplementary resource in English language instruction and contributes to improving the overall quality of foreign language education.

Keywords: Artificial Intelligence; English Language Teaching; ChatGPT; AI-assisted learning; Digital education; Language learning technologies.

Introduction

Mastery of English has become a fundamental requirement in contemporary society, underpinning activities ranging from international travel to professional advancement, academic research, and cross-cultural communication. Historically, learners faced limited options for language acquisition; today, however, educational opportunities have expanded considerably, encompassing classroom instruction, private tutoring, online platforms, and interactive digital resources.

This study investigates the potential of Artificial Intelligence (AI) as an innovative educational instrument capable of enhancing students' abilities in reading, writing, speaking, and listening in English. The primary research question examines whether AI integration into the learning process can substantively improve learners' outcomes.

The objectives of this research are as follows:

1. To evaluate possible applications of AI in English language pedagogy.
2. To identify the most effective AI-based tools for supplementing conventional curricula.
3. To measure the impact of AI utilization on students' linguistic competencies.

The relevance of this investigation stems from the limitations inherent in traditional instructional methods, which often fail to fully engage learners or accommodate diverse learning styles. AI technologies offer individualized learning pathways, provide immediate feedback, simplify task completion, and sustain motivation, thereby enhancing overall instructional efficacy.

Section 1
Theoretical Framework

The Role of Artificial Intelligence in English Language Learning

Artificial Intelligence is progressively reshaping educational practices, particularly in the domain of language instruction. Its implementation introduces new possibilities for both educators and learners, improving efficiency, personalization, and interactivity in the educational experience.

For educators, AI functions as a facilitative tool, automating routine administrative tasks such as grading, test preparation, and performance analysis. This automation enables instructors to dedicate more time to creative and communicative teaching activities, including facilitating discussions, refining pronunciation, and promoting active language use. Moreover, AI-driven analytics provide detailed insights into individual learner progress, allowing for timely adjustments to instructional strategies and fostering adaptive learning environments.

From the learners' perspective, AI enhances engagement by offering interactive and multimedia-rich learning experiences. Virtual dialogues, audio-visual content, and adaptive exercises create an immersive learning environment that accommodates individual pace and minimizes performance anxiety. This approach is particularly beneficial for learners who encounter difficulties in acquiring language skills. Additionally, AI maintains motivation by aligning learning tasks with personal interests and proficiency levels.

Furthermore, AI contributes to educational inclusivity, accommodating diverse cognitive and learning profiles. Personalized learning paths ensure that each student can engage with content effectively and confidently. Consequently, AI complements traditional

methodologies, resulting in more efficient and meaningful English language education.

Methods

AI-Enhanced Platforms for English Learning

A range of AI-driven platforms facilitates language acquisition:

- **Duolingo and Babbel**: Offer gamified, structured lessons designed to improve communicative competence.
- **Quizlet**: Supports vocabulary expansion through customizable flashcards and interactive exercises.
- **Tandem**: Employs AI algorithms to match learners with conversation partners according to interests and objectives.
- **ELSA Speak**: Provides exercises for pronunciation with immediate corrective feedback.
- **Speechling and Pimsleur**: Utilize AI-driven speech recognition to enhance oral communication skills.
- **Kuki and Replika**: Function as virtual conversation partners for immersive practice.
- **Grammarly**: Assists in writing by detecting grammatical and stylistic errors while suggesting improvements.
- **ReadTheory**: Offers leveled reading materials with corresponding comprehension exercises.
- **DeepL Translate and DeepL Write**: Deliver high-accuracy translations and text refinement tools.
- **Semantris**: Uses gamified AI activities to reinforce vocabulary through associative learning.

Applications of ChatGPT in English Language Education

ChatGPT, developed by OpenAI, is a neural-network-based AI capable of producing human-like dialogue. It provides numerous opportunities for language learning:

- **Conversational practice**: Facilitates interactive dialogues, improving practical language use and grammatical accuracy.
- **Grammar guidance**: Explains complex rules and provides contextualized examples.
- **Vocabulary differentiation**: Clarifies subtle distinctions among semantically similar words.
- **Specialized terminology acquisition**: Enables rapid learning of domain-specific vocabulary.
- **Text simplification**: Adapts complex content to learners' language proficiency levels.
- **Stylistic adaptation**: Converts informal text into formal registers suitable for professional or academic contexts.
- **Exercise generation and evaluation**: Produces customized exercises with automated feedback.
- **Text production for reading comprehension**: Generates diverse textual materials, compatible with text-to-speech tools for auditory practice.
- **Writing enhancement**: Functions as a real-time editor, improving grammar, style, and vocabulary.
- **Resource curation**: Suggests supplementary learning materials aligned with learners' levels and objectives.

Discussion

Advantages and Limitations of AI in Language Learning

Advantages:

1. Personalized learning paths tailored to individual needs.
2. Real-time interaction and immediate feedback.
3. Increased efficiency and cost-effectiveness compared to traditional tutoring.
4. Flexible access to educational resources.

Limitations:

1. Absence of a structured, progressive curriculum as found in formal courses.
2. Limited opportunities for social and collaborative learning.
3. Insufficient multimedia support for developing listening and speaking proficiency.

Therefore, AI should be employed as a complementary tool alongside conventional instructional methods, rather than as a replacement.

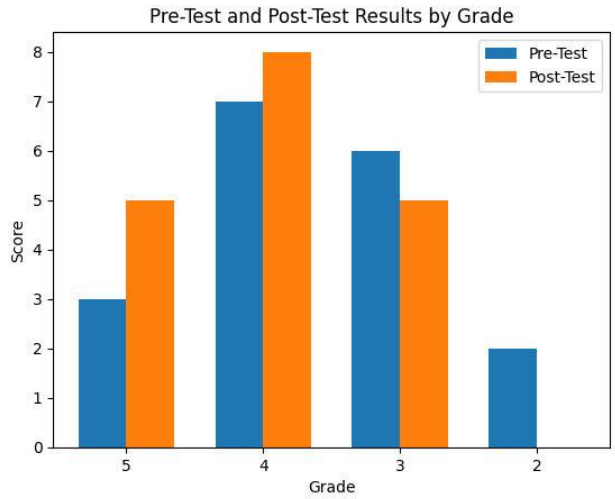
Practical Study

Research Design

This study involved 18 eleventh-grade students over a two-month period (February-March 2026). The research procedure consisted of pre-testing, regular use of ChatGPT for grammar, vocabulary, and writing practice, and post-testing to evaluate learning outcomes.

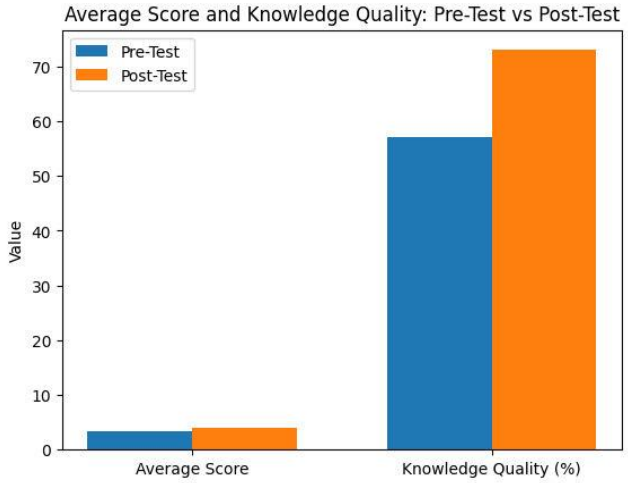
Data for the Charts

Grade	Pre-Test	Post-Test
5	3	5
4	7	8
3	6	5
2	2	0



Average Score and Knowledge Quality:

Indicator	Pre-Test	Post-Test
Average Score	**3.45**	**3.92**
Knowledge Quality (%)	**57**	**73**



Recommended Charts:

1. **Bar Chart: Grade Distribution Before and After the Experiment**

X-axis: Grades (5, 4, 3, 2)

Y-axis: Number of students

Two colors: Pre-Test vs. Post-Test

2. **Line Chart: Progress of Average Score and Knowledge Quality**

X-axis: Testing stage (Pre-Test, Post-Test)

Y-axis: Value (Average Score / Knowledge Quality %)

Two lines: Average Score and Knowledge Quality

Results of the Study

- Students achieving top grades ("5") increased from 3 to 5 (+66.7%).
- Students with grade "4" rose from 7 to 8 (+14.3%).
- Students receiving grade "3" decreased from 6 to 5 (−16.7%).
- No failing grades were recorded.
- The average score improved from 3.45 to 3.92 (+13.6%).
- Overall quality of knowledge increased from 57% to 73%.

The analysis of the obtained data demonstrated a positive trend in students' academic performance after the implementation of ChatGPT in the educational process.

The main results of the study are as follows.

Increase in the number of high grades.

The number of students who received the highest grade ("5") increased from 3 to 5, which indicates a significant improvement in academic achievement.

Increase in the number of grade "4".

The number of students who received a grade of "4" increased from 7 to 8.

Decrease in average results.

The number of students who received a grade of "3" decreased from 6 to 5, indicating a gradual improvement in the overall level of knowledge.

Absence of failing grades.

After the experiment, no failing grades ("2") were recorded, which demonstrates an overall improvement in students' academic performance.

Increase in the average score.

The average academic score increased from **3.45 to 3.92**, representing an improvement of approximately **13.6%**.

Improvement in knowledge quality.

The quality of knowledge indicator increased from **57% to 73%**, demonstrating a substantial improvement in students' mastery of the learning material.

Thus, the results of the experiment confirm the positive impact of using Artificial Intelligence on the effectiveness of English language learning.

Key findings of the research include:

1. **Enhanced academic performance**: The number of high-achieving students increased, the average score rose from 3.45 to 3.92, and knowledge quality improved from 57% to 73%.
2. **Improved grammar and vocabulary skills**: AI tools provided personalized exercises and explanations, allowing students to better understand and apply English grammar and vocabulary.
3. **Increased learner motivation and engagement**: Interactive AI-driven activities, such as dialogues and personalized exercises, maintained student interest and encouraged autonomous learning.
4. **Personalized learning**: AI's adaptive capabilities allowed instruction to be tailored to individual learners' proficiency levels, interests, and needs.
5. **Flexible and accessible learning environment**: Students could practice anytime and anywhere, supporting continuous learning beyond the classroom.
6. **Immediate feedback and error correction**: AI provided real-time guidance, helping students identify and correct mistakes promptly, which accelerated the learning process.

Conclusions

Based on the conducted research, the following conclusions can be drawn.

The use of Artificial Intelligence technologies in English language teaching contributes to improving students' academic performance.

AI tools, such as ChatGPT, support **individualized learning**, allowing educational tasks to be adapted to the level, interests, and needs of each student.

Immediate feedback and explanations of errors help students understand grammatical rules more effectively, improve writing skills, and expand their vocabulary.

The use of interactive AI tools increases **students' motivation and engagement** in the learning process, making education more interesting and effective.

Artificial Intelligence technologies create a more **flexible and accessible learning environment**, enabling students to practice English at any time and beyond the classroom.

Despite its significant advantages, Artificial Intelligence should be considered **a supplementary educational tool** that should be used alongside traditional teaching methods.

Overall, the results of the study confirm that the integration of Artificial Intelligence into foreign language teaching can significantly improve the quality of education and promote the development of students' independent and effective learning skills.

The study demonstrates that AI integration, particularly through ChatGPT, significantly enhances the effectiveness of English language learning. Principal advantages include:

1. Individualized instruction that addresses specific learner needs.
2. Increased motivation through interactive and adaptive activities.
3. Development of learner autonomy and self-directed study.
4. Flexible access to learning resources, independent of location or time.
5. Immediate error correction and performance feedback.

In conclusion, AI technologies, when judiciously combined with traditional instructional methods, provide a more flexible, personalized, and effective learning environment, consistent with the demands of contemporary digital education.

The conducted study demonstrates that integrating Artificial Intelligence, particularly Chat GPT, into English language instruction significantly enhances students' learning outcomes. The practical application of AI in the classroom led to measurable improvements in both linguistic competence and overall academic performance.

In conclusion, the study confirms that AI serves as a valuable supplement to traditional teaching methods, rather than a replacement. Combining innovative AI technologies with conventional pedagogy creates a more effective, flexible, and personalized learning environment, aligning with the requirements of modern digital education. The integration of AI in English language teaching not only improves measurable academic outcomes but also fosters greater student autonomy, motivation, and confidence, which are essential for successful language acquisition in the 21st century.

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PHILOLOGICAL SCIENCES

ХУДОЖЕСТВЕННЫЙ МИР ЛИТЕРАТУРНОЙ СКАЗКИ I ТРЕТИ XIX СТОЛЕТИЯ

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THE ARTISTIC WORLD OF LITERARY FAIRY TALE OF THE FIRST THIRD OF THE 19TH CENTURY

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Аннотация

«Сказка о золотом петушке» традиционно начинается с возникшей проблемы и несчастья. Дадон не может сдержать обещания, данного им звездочету, и это ведёт его к трагическому финалу.

Он не следует заповедям добра и благодарности, и гибель к нему приходит со стороны всё того же золотого петушка, который в начале рассказа был для него чудесным приобретением.

Жанр литературной сказки в духе православной христианской традиции получил дальнейшее развитие в творчестве П.П.Ершова. В повествовательной структуре волшебной сказки писатель использует одну из самых ярких её функций-функцию запрета и его нарушения, которая скрепляет весь каркас литературного текста.

В сказке П.Ершова происхождение главного героя намеренно социально снижено. Он простой крестьянский сын, которого старшие братья считают дурачком и неудачником. Иван в сказке П.Ершова похож больше на библейского Иосифа, который обладает милосердием и в итоге прощает своим братьям все их злодеяния. Иван обладает чувством ответственности и держит свое слово. Таким образом, создаётся психологический портрет главного героя и его чудесного помощника коня-горбунка. В сказке П.Ершова очевидно влияние православной христианской традиции. В фольклорной народной сказке чудеса совершаются с помощью волшебных помощников, а в сказке П. Ершова вводится твёрдое объяснение, что чудеса способен творить только божественный создатель.

Abstract

"The Tale of the Golden Cockerel" traditionally begins with a problem and misfortune. Dadon fails to keep the promise he made to the astrologer, and this leads him to a tragic end.

He fails to follow the commandments of kindness and gratitude, and his death comes from the same golden cockerel, which at the beginning of the story was a miraculous acquisition for him.

The genre of the literary fairy tale in the spirit of the Orthodox Christian tradition was further developed in the work of P.P. Ershov. In the narrative structure of the fairy tale, the writer utilizes one of its most striking functions—the function of prohibition and its violation, which holds together the entire framework of the literary text.

In P. Ershov's tale, the protagonist's social origins are deliberately debased. He is a simple peasant son, considered a fool and a loser by his older brothers. Ivan in P. Ershov's tale is more like the biblical Joseph, who possesses mercy and ultimately forgives his brothers for all their misdeeds. Ivan has a sense of responsibility and keeps his word. Thus, a psychological portrait of the protagonist and his miraculous assistant, the Little Humpbacked Horse, is created. P. Ershov's tale clearly shows the influence of the Orthodox Christian tradition. In folklore, miracles are performed with the help of magical assistants, while P. Ershov's tale introduces a firm explanation that only a divine creator can perform miracles.

Ключевые слова: сказочный цикл, христианская традиция, аналогия, социальная направленность, модель христианского мира, повествовательная структура, национальная идентичность.

Keywords: Fairy tale cycle, Christian tradition, analogy, social orientation, model of the Christian world, narrative structure, national identity.

Пушкинская «Сказка о золотом петушке» завершает сказочный цикл поэта. Исследователи обращались к истокам выбранного А.С. Пушкиным сюжета, но не нашли определенных аналогий ни в русском фольклоре, ни в его черновых авторских записях. А. Ахматова полагала, что аналогии следует искать в западной традиции, и в этом смысле ссылалась на новеллу Вашингтона Ирвинга «Легенда об арабском звёздочете». А. Ахматова приводила примеры сходства сюжетных линий обоих текстов, но и определила чисто пушкинские мотивы [1]. В частности, она пришла к выводу о существовании политического подтекста в пушкинской «Сказке о золотом петушке», мотивируя это тем, что в образе царя Дадона отразились два облика русских царей, один из которых не питал к нему никакого расположения, а другой одарил уничижительным для поэта чином камер-юнкера.

Анализом пушкинского текста занимались впоследствии также И.Лупанова и Р.Волков, которые трактовали образ Дадона не в духе политической сатиры, а в духе тональности и сатирического характера русской бытовой сказки [2], [3].

«Сказка о золотом петушке» традиционно начинается с возникшей проблемы и несчастья. Дадон, грозный и могущественный в молодости царь, к старости оказался неспособным отражать вражеские нападения своих противников. Эта беда побуждает Дадона обратиться за помощью к мудрецу-звездочету, из рук которого он получает чудесного помощника в виде золотого петушка.

Далее на жизненном пути Дадона встают испытания, которые он не выдерживает ни в роли главы своего царства, ни в функции отца двух сыновей и в итоге окончательно роняет свое человеческое достоинство как человек, не умеющий держать своё слово.

При виде шамаханской царицы Дадон забывает о трагической гибели собственных сыновей и пирует вместе с ней над их трупами. Очевидно, что А.С.Пушкин создаёт образ глубоко порочного сластолюбца. Но шамаханская царица выступает в роли внезапно явившейся и также внезапно исчезнувшей ведьмы-оборотня, которая очаровала престарелого царя своей колдовской силой. Дадон не может сдержать обещания, данного им звездочету, и это ведёт его к трагическому финалу.

Он не следует заповедям добра и благодарности, и гибель к нему приходит со стороны всё того же золотого петушка, который в начале рассказа был для него чудесным приобретением.

Жанр литературной сказки в духе православной христианской традиции получил дальнейшее развитие в творчестве П.П.Ершова.

Литературоведы ставили в заслугу П.Ершову, что он перенёс фольклорный образ Ивана-дурака в своей художественный нарратив, ,придав ему характерную индивидуальность и новые черты» [4]. Литературная сказка у П.Ершова обрела большую социальную направленность. В сказке получился довольно сатирический образ царя и подводное царство по сути служит пародией на царство земное.

Сказка П.Ершова «Конёк-горбунок» не является, по словам самого автора, оригинальной по выбору сюжета. Писатель признавался, что замысел сказки взят из уст других рассказчиков и «приобрёл под его пером соответствующую литературную доработку» [5, 143].

В литературоведении укрепилось мнение, что текст П.Ершова являет собой своеобразное попурри из русских народных сказок. Однако П.Ершов при сохранении основных композиционных особенностей народной волшебной сказки «шёл своим путем в разработке жанра сказки литературной» [6, 67].

В повествовательной структуре волшебной сказки писатель использует одну из самых ярких её функций-функцию запрета и его нарушения, которая скрепляет весь каркас литературного текста. Кроме того, многие мотивы волшебной фольклорной сказки П.Ершов оставляет без внимания. В его сказке «Конёк-горбунок» нет использования, в частности, мотива чудесного рождения или потери родителей у главного героя.

В заключительной части писатель, напротив, усложняет сюжетную канву, вводя рассказ о путешествии Ивана к морю-океану и описание его встречи с Китом Китовичем.

В народной версии «Конька-горбунка» действует либо Иван-царевич, либо Иван-купеческий сын в образе крепкого, умного и смелого молодца. В сказке П.Ершова происхождение главного героя намеренно социально снижено. Он простой крестьянский сын, которого старшие братья считают дурачком и неудачником. Но на самом деле герой сказки П.Ершова не совершает ни одного глупого поступка. Напротив, во многих делах Иван проявляет недоступную его братьям смекалку и находчивость. Дураком выглядит Иван в глазах своих братьев благодаря своей доброте, простодушию и отсутствию корыстолюбия.

Иван в сказке П.Ершова похож больше на библейского Иосифа, который обладает милосердием и в итоге прощает своим братьям все их злодеяния.

Иван обладает чувством ответственности и держит свое слово. Только он выполняет свое общение отцу и добросовестно охраняет отцовское поле. Ему как человеку свойственным и слабости. Иван способен на ложь, но при этом и готов к искреннему раскаянию. Таким образом, создаётся психологический портрет главного героя и его чудесного помощника коня-горбунка.

Под стать крестьянскому происхождению Ивана и его четвероногий помощник, который не выглядит как холёный конь русского богатыря, а имеет наружность захудалого и заезженного деревенского жеребца.

Но для П.Ершова образ коня-горбунка является одним из центральных сказочных персонажей. Он не только помощник и добрый советчик Ивана

в самых трудных ситуациях, но и выступает в качестве исполнителя особенно трудной задачи. Конек-горбунок морально поддерживает своего хозяина и одобряет его поступки своей похвалой.

Их отношения не укладываются в парадигму слуга-хозяин, так как по сути Иван со своим конём-горбунком являются друзьями и соратниками, совместно переживающими стоящие перед ними трудности и опасности. Промахи Ивана конек-горбунок рассматривает как их общие ошибки и неудачи. Такие отношения между героем его конём никогда не возникали в фольклорной волшебной сказке, в которой конь всегда оставался на подчинённом положении преданного слуги своего хозяина.

В сказке П. Ершова очевидно влияние православной христианской традиции. В литературном тексте воссоздается модель православного мира, пространство иноземных восточных стран и образ небесного Царства, в котором живут Солнце и Месяц. Во время путешествия братья видят вход в чудесный терем, в котором столбы ворот завиты в причудливые золотые змейки, а на верхушке сияют три звезды, обозначающие согласно христианской вере три ипостаси Создателя-отца, сына и святого духа. Картину завершает православный крест, который является символом величия христианского учения.

Христианский флёр окутывает весь художественный нарратив сказки П.Ершова «Конёк-горбунок».

Братья представляют тот тип религиозного сознания, в котором отсутствует фактор сомнения, так как именно он является признаком нетвердости в православной вере. Они осеняют себя крестным знаменем, будучи безусловно уверены, что именно оно оградит их от возможных опасностей и бед. Братья перед путешествием молятся иконам и просят отцовского благословения, что тоже очень важно в православной христианской традиции.

В фольклорной народной сказке чудеса совершаются с помощью волшебных помощников, а в сказке П. Ершова вводится твёрдое объяснение, что чудеса способен творить только божественный создатель. Описание брачного обряда Ивана с его невестой дается также в традиции и православного христианства. На аналое в церкви лежит Евангелие в качестве предикта православных устоев будущей счастливой супружеской жизни.

А.С. Пушкин высоко отзывался о таланте П. Ершова-сказочника и далее заявил, что этот жанр следует ему оставить, так как достойный приёмник в русской литературе у него уже есть.

А.С. Пушкина и П. Ершова сближало общее понимание народности и восприятия сокровищницы русского «фольклора с позиции высокой духовности и национальной идентичности» [7, 99].

Если говорить о повествовательной структуре сказок П. Ершова, то следует отметить, что он, в отличие от А.С. Пушкина, стремился к усложнению сюжетных коллизий. В сказке «Конёк-горбунок» П. Ершова можно проанализировать десять основных мотивов, обеспечивающих динамику сюжетного действия. В третьей части сказки появляется встреча Ивана с китом, который проглотил три десятка кораблей, затем следует его челобитная к Месяцу, а далее-поиск ерша, способного найти на дне моря сундучок с кольцом Царь-девицы и другие мотивы. Но весь повествовательный каркас сказки удерживается на дилеммах запрет-нарушение, трудная задача-её успешное решение, что в целом соответствует поэтике жанра русской народной волшебной сказки.

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КОНЦЕПТ КУЛЬТУРНОЙ ПАМЯТИ В АСПЕКТЕ ЛИТЕРАТУРНОГО ТВОРЧЕСТВА

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THE CONCEPT OF CULTURAL MEMORY IN THE ASPECT OF LITERARY CREATIVITY

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Аннотация

Культурная память существуют на интеллектуальном и семиотическом уровнях и обеспечивает преемственность традиции. Она формирует плодотворный диалог различных исторических времен и их персоналий в литературном тексте.

Культурная память связана в этом смысле с неким вневременным дискурсом в культурном общении человеческой коммуникации и выступает в качестве своеобразной матрицы художественного мышления личности как такового.

Культурная память избирательна по своему характеру, имеет творческую составляющую и основана на сознательном отборе автором отрывков из текстов других авторов и других исторических эпох. Автор литературного произведения является творцом культурной памяти для следующих поколений и использует её кладовую в форме интертекстуальности.

Abstract

Cultural memory exists on both the intellectual and semiotic levels and ensures the continuity of tradition. It fosters a fruitful dialogue between different historical periods and their personalities in a literary text.

In this sense, cultural memory is linked to a certain timeless discourse in cultural communication and acts as a kind of matrix for the artistic thinking of the individual as such.

Cultural memory is selective in nature, has a creative component, and is based on the author's conscious selection of excerpts from texts by other authors and from other historical eras. The author of a literary work creates cultural memory for future generations and utilizes its storehouse in the form of intertextuality.

Ключевые слова: культурное наследие, литературный текст, ментальность, метатип, интеллектуальный и семиотический уровни.

Keywords: Cultural heritage, literary text, mentality, metatype, intellectual and semiotic levels.

Понятие культурная память не аналогично понятию память культуры. Память культуры предполагает принадлежность к определенному культурному слою или эпохе. Культурная память, в отличие от нее, имеет «ввиду фигуру субъекта, который ею обладает в определенном количественном и качественном объеме» [1, С. 131].

Термин «культурная память» определяется преемственностью, восприятием наследия, а также соотношением традиции и новаторства. Культурная память процессуальна по своей природе, так как существует в координатах исторического времени. Её продуктом являются памятники материальной и духовной культуры, связанные с национальной традицией и менталитетом. В содержание духовной культуры входит система религиозных верований и поведенческих мотивов. Культурная память предполагает процесс взаимоотношения

культурного наследия, культурного кода и субъекта сознания в лице определенного реципиента.

Человеческая личность формирует свою природу на основе определенного исторического опыта, географического ореола, а также на основе мифологии, принадлежности к религиозному сообществу и социальному опыту. Личностная состоятельность включает в себя принятие общепринятых норм поведения и морально-эстетических ценностей и идеалов. Сформировавшаяся личность обладает межнациональной и межкультурной толерантностью, готова к плодотворному культурному диалогу и способна к оценке «той экономической модели и тех социальных институтов, в пространстве которых она существует» [2, С. 119].

Личность сама постоянно находится в процессе поддержания и развития культуры. В этом отношении история культуры предполагает тенденцию движения и увеличения объема культурной памяти. Этот процесс представляет собой форму открытого диалога между текстами и памятниками духовной и материальной культуры и субъектами, которые их воспринимают и осваивают в своём сознании. Это по сути двусторонний процесс, так как люди создают культуру и «они же её воспринимают, то есть являются субъектом и объектом культурного процесса в целом» [3, С. 97].

Литературный текст является одной из разновидностей хранения культурной памяти, ибо в нём отражается духовный мир личности и проявляется содержание культуры как таковой. В литературном тексте присутствует информативная насыщенность с точки зрения национальной ментальности, национального типа характера и этнографии.

Сознание личности выступает как отражение объективной реальности в субъективной форме, которая маркируется опосредственными способами и нормами человеческой коммуникации. В антологическом аспекте возникающая в сознании личности отображенная и только «ему присущая субъективная реальность содержит ценностное и критическое отношение в объективной окружающей действительности» [4, С. 19].

Человеческое сознание, воспринимающее реальность, характеризуется творческой интенцией, умением определять цели и направление деятельности, а также феноменом саморефлексивности.

Человеческое сознание основано на познании законов окружающего мира, предполагает построение с ним определенных отношений и регулирование личностного поведения.

Личности свойственны также осознание и анализ личных интимных переживаний и потребность в творчестве, которое обеспечивает обновление и отражение уже имеющегося культурного наследия. Личность способна сохранять самоконтроль и оценивать свою деятельность с позиции эстетического и этического отношения к культурной памяти. Человеческая природа не рациональна по своей сути и включает в себя категорию бессознательного. В этой категории нет логических критериев, и поэтому она основана на эстетическом чувстве. Эстетическое чувство возникает на уровне интуиции, но затем апробируется на уровне сознания, то есть на уровне определенной логики. В результате умственного качественного отбора возникает наиболее жизнеспособный и актуальный для писателя художественный образ.

Культурная память объединяет сознание личности и сферу подсознательного в единое целое, благодаря огромной доли творческого приращения.

Содержанием «бессознательного уровня культурной памяти является ментальность определенного личностного типа как таковая» [5, С. 99].

Ментальность выступает как способ восприятия действительности, имеющий устойчивые национальные и исторические характеристики. В неё входит совокупность образов, понятий и представлений, отражающих глубинный пласт коллективного сознания отдельного индивида. Содержание культуры определяет характер ментальности и её оценочную градацию.

Менталитет – это общая духовная общность человеческой коммуникации, которая зависит от социокультурных, этнических, географических и языковых особенностей. Он проявляется в поведенческой практике, манере говорить и формирует специфику психологической и лингвистической составляющей человеческого интеллекта.

В этом аспекте художественная литература представляет собой своеобразный интертекст самой действительности. Это эстетическая форма проявления человеческого сознания.

Любой художественный текст имеет языковое воплощение и фиксирует, воспроизводит и передает определенный характер информации.

Язык представляет собой важнейшую часть мировой культуры, которая как бы осуществляется с помощью него как основного орудия. Язык составляет основной образ определенной нации и национальной культуры. В нем раскрываются основные особенности национального менталитета. Язык «отражает сферу сознания человека и как бы расшифровывает в звуках и знаках человеческое восприятие окружающего мира» [6, С. 87].

Если рассматривать язык в качестве хранителя культуры, то важно понимать, что он, несомненно, обладает кумулятивной функцией, но при этом выступает в виде формы, особого механизма, некой структуры с помощью которой сохраняется, передается и кодируется определенная информация. Культурная память как таковая хранится и воспринимается благодаря связному тексту, имеющему особую организацию и содержательный смысл. Но, с другой стороны, правила построения и графического оформления текста диктуются языковыми особенностями и культурной традицией.

Исходя из этого текст становится объектом внимательного изучения специалистами из разных областей научного знания. Тексты исследуются в семиотическом и интертекстуальном аспектах, что даёт возможность проследить их связь с определенной культурой и выявить значимость и функциональность в смысле хранения и последующей трансляции культурной памяти.

М. Бахтин создал на основе изучения творчества Ф. Достоевского теорию полифонии, которая

реализуется в художественном произведении в форме межтекстового диалога [7;8].

На основании этих исследований другим филологом Ю. Кристевой было сформировано понятие интертекстуальности. В это понятие вкладывалось убеждение в том, что каждый текст по сути содержит в себе интертекстуальную природу. Это убеждение основано на том, что все тексты заключают в себе наследие предшествующей культурной традиции и языковой культуры. Поскольку язык как форма человеческого общения существовал задолго до возникновения каких бы то ни было текстов, в каждом из них живут ритмические структуры, языковые формулы и идиомы, присущие определенной национальной принадлежности и исторической эпохе.

Интертекст восходит к цитированию, но в художественном произведении цитата не представляет собой точное воспроизведение чужого высказывания. В этом смысле цитата принимает форму некой осознаваемой аллюзии, в которой содержится намек или упоминание определенного факта, наводящего на воспоминания о другом писателе и его литературном тексте.

В книге Ж. Женетта «Палимсесты» цитата рассматривается в качестве функционально-стилистического культурного кода, и в этом отношении в тексте определенного автора может присутствовать интертектуальность в более узнаваемом виде, когда читатель сталкивается с цитатами из других текстов и очень просматриваемыми аллюзиями. Даже отношение целого текста к одной своей части, в качестве которой могут выступать, например, эпиграф, вставная новелла или даже заглавие, порождает понятие паратекстуальности. Соотношение текста со своими же предтекстами трактуется как метатекстуальность; пародирование одного текста другим связаны с понятием гипертекстуальности, а жанровые связи различных текстов позволяют говорить о явлении архитекстуальности [9].

Процесс понимания смысла интертекста, заложенного в литературном произведении, порождает проблему некого идеального читателя, способного постичь его в полном объеме. Проблема читателя и уровня его понимания прочитанного предполагает открытый характер рецепции и интеллекта, который обеспечивает качество диалога между писателем и его аудиторией. Читатель вступает в процесс культурного сотворчества, и в его задачу входит не только дешифровка культурных кодов, заложенных в литературном тексте, но и обогащение его своими личными ассоциациями, продиктованными преференциями и жизненным опытом.

Таким образом происходит некий культурный дискурс писателя и его заинтересованного читателя.

В филологической науке существует множество определений понятия «дискурс». Он понимается как синонимичный диалогу или разговору двух субъектов и как некая формализованная текстовая структура, которая маркирует определенные ментальные особенности. Дискурс также рассматривается как внутритекстовое образование, в котором присутствует синтез субъекта и способа его высказывания (В.И. Тюпа). Дискурс также трактуется как новое высказывание, имеющее личностный оттенок и не претендующее на объективность, но маркирующее обратную связь со своим реципиентом (Ю.Б. Борев) [10]. Другое определение дискурса подчеркивает наличие коммуникации двух партнеров, в ходе которой решающее влияние имеют цели, чувства и индивидуальный жизненный опыт каждого из них.

Если текст рассматривается через явления дискурса и интертекста, то возникает проблема способности человеческого сознания освоить некий первоначальный текст и в процессе литературного творчества представить его модификацию творчески мыслящему реципиету.

Текст представляет собой систему знаков. Эта область в литературоведении изучается семиотикой. Необходимость в создании общей теории знаков высказывалась ещё Дж. Локком в его труде «Опыт о человеческом разуме» (1690), и затем эта мысль была развита в процессе интеграции логики в работах Т. Фрете и Ч. Пирса и структурной лингвистики, представленной в трудах Ф. де Соссюра и Бюиссена [11].

В работах Ю. Лотмана разработана теория семиотики культуры, которая рассматривалась в аспекте структурализма и нарратологии. Он утверждал, что текст представляет собой симбиоз различных языков культуры, которые просматриваются на синхроническом и диахроническом уровнях. Отсюда в тексте живёт некая память, порождающая новые смыслы путём взаимодействия, смещения и вариации отдельных его элементов [12].

Опыт человечества представляет собой в этом отношении внешнюю форму коллективной памяти, а внутренняя память хранит предшествующие чувства и эмоциональные состояния.

Прошлое не уничтожается в человеческой памяти, а подвергается сложному кодированию, «хранится в отдаленных уголках сознания, чтобы вновь проявиться в ясной форме в нужных обстоятельствах» [13, Т.1, С. 49].

Текст способен хранить информацию с помощью различных культурных кодов и трансформировать ее, и в этом смысле осуществляется диалог создателя текста и его реципиента посредством семиотического общения, в основе которого лежит знак.

Знаки могут рассматриваться как естественные и маркирующие окружающую природу. Они могут быть функциональными, то есть порождаться в результате непосредственной деятельности человека. Знаки определяются в семиотике как конвенциональные и иконические. Первые выступают в качестве условных сигналов или индексов, а вторые представляют некие образы. Далее выделяются вербальные знаки, под которыми понимаются естественные языки, и знаковые системы записи различных видов текстов.

Семиотика сосредоточена на эстетическом значении знака, выявляя связи между художественными произведениями и их семантикой. Семиотика

также ставит своей целью выявить структурные соотношения между эстетической и художественной природой знака и пытается дать характеристику коммуникативной функции искусства в аспекте прагматики.

В работе М.К. Мамардашвили и А.М. Пятигорского «Символ и сознание» делается акцент на разделении понятий «символ» и «знак». «Знак понимается как некое обозначение, которое маркирует материально выступающий объект или ситуацию, которые понимаются носителями информации в абстрактной форме» [14, С. 13]. А символ трактуется как некое внезнаковое понятие, которое может быть, понято верно или не понято совсем. В этом смысле к символу ближе всего стоит метафора, но в ней нет такой загадочности, которая присутствует в символе.

В этом аспекте, художественный символ, понимаемый в широком культурном значении, представляет собой некую форму выражающую мировоззрение личности, её представления, ценности и взгляды, которые и обеспечивают сохранность и развитие самой культуры как таковой.

Символ играет важную роль в передаче культурной памяти от поколения к поколению. В природу символа заложены начала нового и вечного. В нем обозначены основы прежних культурных знаний и ценностей, но, с другой стороны, символ активно взаимодействует с новыми реалиями объективной ситуации или исторической эпохи и переживает процесс своей трансформации.

Символ живёт в глубинах человеческой памяти, но в сознании художника он актуализируется и включается в художественный текст.

Литературный текст предполагает сложное взаимодействие автора и читателя. Передача культурной памяти с помощью текста сопровождается обогащением сознания и эмоциональной сферы предполагаемого реципиента. Чтобы этот процесс состоялся, необходимо взаимопонимание текста и читателя. Текст предлагает читателю диалог, а адресат в качестве читателя пытается постигнуть многообразие его символов при помощи информационной подготовки и соответствующего уровня интеллекта.

В любом национальном образовании живут культурные универсалии в качестве религии, табу, мифов и языка. Культурные универсалии маркируют внешний мир личности, но, в тоже время, отражают культурные и нравственные ориентиры определенного этноса. Эта двусторонность порождает семантическую ёмкость и ведёт к формированию символов исторических событий и эпох.

Духовной составляющей отдельной человеческой культуры является миф, который «согласуется с глубинными сакральными областями реальности, но в сознании личности он воспринимается на уровне символа, аллегории или знака» [15, С. 9].

Архетип считается в науке основой любого мифа. К. Юнг относил архетип к категории коллективного подсознательного, в котором хранится вся концентрация предшествующего человеческого опыта. Архетип выступает в роли «некой первоначальной матрицы» [16, С. 9], которая стимулирует дальнейшее развитие человеческой фантазии, обретающей облик символа.

Преобразование определенного авторского замысла в литературный текст связано с художественным переосмыслением определенного архетипа.

Творческий процесс представляет собой гармонию логического мышления и эмоциональной сферы человеческого сознания. В этом процессе взаимодействуют категории конкретного и абстрактного, сознательного и бессознательного. Сознание производит селекцию тех архетипов, которые актуальны в данный момент для автора литературного текста. Они стимулируют его воображение, оформляют череду его воспоминаний и впечатлений и создают личностную перспективу саморазвития и творчества.

Согласно теории К. Юнга, бессознательное крайне важно для мировой культуры, так как выступает в качестве стимула творческого воображения.

Теория К. Юнга нашла развитие в работе С. Аверинцева «Аналитическая психология», в которой архетип представлен в виде коммуникативной модели, «основу которой составляют некие матричные характеристики» [17, С. 39]. В архетипе выделялась многоуровневая структура, вектор которой шел от простейших индивидуальных представлений личности к мировосприятию общенационального и, более того, общечеловеческого масштаба. В работах зарубежного исследователя Н. Фрайя заявлялось о внутренней связи архетипа и литературного творчества и давалась характеристика поступательного развития мировой литературной традиции [18].

Большое внимание в этом аспекте уделялось понятию «литературный архетип» как части сознания творческой личности. В этом смысле архетип рассматривается как продукт мифологии и собственно литературы.

Устойчивое ядро архетипа не исключает множество самых различных вариаций. В работах в Е. Мелетинского и С. Небольсина архетип рассматривается в парадигме его модификаций, которая по сути «обеспечивает традицию преемственности в художественном творчестве» [19, С. 19].

Ментальное образование совершает путь преобразования в общепризнанный литературный канон. Устоявшийся в человеческом сознании миф превращается в мифологему, которая синонимична литературному архетипу. Миф и архетип как глубинные ментальные образования становятся неким фактом культурной традиции, который обусловлен способностью личности к образно-символическому мышлению. Бессознательное передает свою содержательность посредством рациональной среды сознания личности.

Архетипические и мифологические образы воссоздаются при помощи символа, а литературный архетип и мифологема связаны с областью семиотики.

Целостная картина мира, воссоздаваемая человеческим воображением, имеет опорные ядерные

культурные концепты, близкие для всего человеческого сообщества. Такими концептами обладают понятия свободы, семьи, счастья, души и так далее. Это некие духовные ориентиры и ценности, смысл которых реализуется в символах и знаках. В сознании художника концепт определяет направление его творческой мысли. В соответствии с авторским замыслом в процессе литературной работы осуществляется актуализация и цитация, которые важны для понимания художественного нарратива. В сферу интересов литературоведов, исследующих области культурологии, семиотики и проблемы интертекстуальности, входит понятие исходного цитируемого текста. Этот прецедентный текст может быть важен автору в познавательном или эмоциональном смыслах. Он также может иметь более широкий надличностный характер и может быть хорошо в этом смысле известеным широкому кругу его читателей, и более – его современников и предшественников.

В качестве такого типа прецедентных текстов могут выступать архетипы и мифы. Они широко известны в определенной человеческой коммуникации и имеют множество вариантов. Выбор прецедентных текстов, несомненно, также обусловлен целым рядом автобиографических фактов из жизни писателя, а также связан с реалиями и событиями определенной исторической эпохи. Такого рода тексты служат обновлению культурной памяти и человеческой коммуникации в целом, но в этом случае в них отражаются не сиюминутные состояния и эмоции, а основополагающие проблемы человеческого бытия в целом.

Архетипическую структуру имеет и определенная жанровая модель, которая существует в культуре достаточно долгое время. Такая память жанра, характерна, в частности, для пасторали, которая ожила в новых образах сельских идиллий романов И. Гончарова и И. Тургенева, живописавших историю русских «дворянских гнёзд».

Особым долголетием отличаются религиозные и мифологические сюжеты, связанные с фольклорной традицией. Достаточно назвать образы Золушки, злой мачехи и бедной вдовы, Каина и Авеля, которые нашли литературные перевоплощение во множестве художественных произведений.

От прецедентного текста можно перейти к прецедентному имени, которое также получило черты литературного архетипа. Образы Обломова, Дон Кихота, Дон Жуана, «лишнего человека» стали основой для их творческой разработки во множестве последующих литературных текстах. Это так называемые вечные образы или метатипы, которые связаны с природой человеческой личности или являются отражением тенденций своей исторической эпохи.

Художественный метатип может реализовываться в литературном творчестве в конкретных персонажах, которые становились знаковыми для своей исторической эпохи. Метатип обладает устойчивостью своих отличительных характеристик и соотносится с культурной и социально-общественной средой.

Культурная память существуют на интеллектуальном и семиотическом уровнях и обеспечивает преемственность традиции. Она формирует плодотворный диалог различных исторических времен и их персоналий в литературном тексте.

Культурная память связана в этом смысле с неким вневременным дискурсом в культурном общении человеческой коммуникации и выступает в качестве своеобразной матрицы художественного мышления личности как такового.

Культурная память избирательна по своему характеру, имеет творческую составляющую и основана на сознательном отборе автором отрывков из текстов других авторов и других исторических эпох. Автор литературного произведения является творцом культурной памяти для следующих поколений и использует её кладовую в форме интертекстуальности.

От читателя в этом случае требуется определенная эрудиция и знание предшествующего культурного опыта с тем, чтобы понять смысл и назначение интертекстуальности в данном конкретном художественном произведении. Более того, любое значимое художественное творчество приобретает новое прочтение в последующих исторических эпохах и тем самым как бы приобретает новые смыслы. Таким образом, ретроспективность и оценка сложившийся литературной традиции способствует поступательному движению творческого процесса в самом широком смысле этого понятия.

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THE GEOGRAPHICAL MAP OF THE STUDY OF DOUBLE MODALITY IN WORLD LINGUISTICS

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Abstract

The presented article is devoted to an analysis of research on the phenomenon of double modality in English within world linguistics, examined in terms of its geographical distribution and scientific directions. It is known that double modality is one of the relatively rare and underexplored areas in global linguistics; nevertheless, this phenomenon has been studied within various theoretical frameworks. In particular, the more frequent use of double modality in non-standard English dialects has drawn linguists' attention to this field. Research conducted under the terms "double modality," "double modals," and "multiple modals" has mainly developed in three directions: dialect syntax within the study of World Englishes, semantic and pragmatic analysis, as well as corpus-based research.

The aim of the article is to identify the geographical distribution and the main research centers of studies devoted to the phenomenon of double modality, to systematize the research carried out in this field, and to outline its principal directions. During the study, scientific articles, monographs, and corpus-based research published in various countries were comparatively analyzed. In fact, the main purpose of writing this article is to investigate linguists who conduct research on this topic, to examine the classical and fundamental works produced by them, and to review dialectal studies. One of the key objectives is also to determine the use of double modality in Standard English and to identify which linguists have studied it, since the investigation of double modality in Standard English, alongside non-standard English, is considered one of the central issues in linguistics and is analyzed as such. Undoubtedly, examining when research on this topic began is also one of the essential aspects of the study.

Keywords: double modality, double modals, modality, dialect syntax, standard English, non-standard English, corpus research.

Introduction

Modality in linguistics is regarded as one of the key grammatical and semantic categories through which a speaker expresses their attitude toward a proposition, including such meanings as probability, necessity, obligation, and possibility. In the English language, modality is characterized by a wide range of lexical and grammatical means of expression and, in comparison with many other languages, is particularly associated with the extensive use of modal verbs. One of the distinctive features of English is the possibility for two or more modal elements to co-occur within a single sentence. This linguistic phenomenon is commonly referred to as *double modality* or *double modals* in the linguistic literature. (Nuriyeva, 2024)

The study of double modality dates back to the 1970s and has since attracted increasing attention from linguists worldwide. It has been examined within several major areas of linguistic inquiry, including grammar, semantics, pragmatics, and, more recently, corpus linguistics and sociolinguistics. Double modality may be considered an integral component of the broader category of modality, as it reflects the speaker's ability to encode multiple layers of modal meaning within a single syntagmatic structure. When expressing an attitude toward an action, state, or situation, speakers may employ not only one but sometimes two or even three modal elements, thereby creating complex modal constructions that convey nuanced meanings and subtle distinctions. (Nuriyeva, 2025)

Such constructions often serve to intensify or refine the speaker's stance, allowing for the simultaneous expression of different shades of meaning, such as possibility combined with obligation or probability combined with intention. In this respect, double modality contributes to the expressive richness of language and reflects the dynamic nature of actual language use. At the same time, it should be noted that the majority of traditional studies on modality have focused primarily on single modal elements—such as modal verbs (*may, might, can, could, must, should, shall, would, will, dare*) or modal adverbs (*perhaps, probably, certainly*). These elements have often been analyzed in isolation, typically at the sentence level, without sufficient attention to their interaction within more complex modal structures. (Nuriyeva, 2024).

In contrast, naturally occurring discourse demonstrates that modal expressions frequently interact and combine, giving rise to layered or multiple modality. This is particularly evident in non-standard varieties of English, where double modal constructions such as *might could*, *may might*, *might should*, and *used to could* are more commonly attested. However, recent research suggests that elements of double modality may also be observed in more formal or standard varieties of English, although often in less prototypical or more structurally complex forms. (Hasty, 2012).

Within this context, the present study aims to contribute to the ongoing discussion by examining the phenomenon of double modality from a broader, global perspective. By focusing on the geographical distribution and main research directions in world linguistics, the article seeks to systematize existing studies, identify key research centers, and highlight the main theoretical and methodological approaches that have shaped the development of this field. Such an approach allows not only for a better understanding of the current state of

research on double modality but also for the identification of gaps and перспективеs for future investigation.

In contrast, actual language use in discourse reveals more complex modal patterns; among these are constructions in which two modal elements occur together in combination. This linguistic phenomenon, primarily found in non-standard varieties of English, is known as *double modality*. (Di Paolo, 1989).

Double modals are particularly widespread in non-standard English dialects, especially in the southern dialects of the United States and in certain regional varieties of English. These constructions are expressed through forms such as *might could*, *may might*, *might should*, *used to could*, and others, enabling speakers to convey multiple modal meanings—such as probability, possibility, and necessity—simultaneously. (Mishoe, M., & Montgomery, M., 1994)

Although the phenomenon of double modality has long been regarded in linguistic literature as a peripheral and dialect-specific feature, interest in this area has increased significantly in recent decades. Contemporary research has shifted toward examining double modals not only from the perspective of dialect syntax but also within semantic, pragmatic, and corpus-based frameworks.

The aim of the present article is to identify the geographical distribution of research on double modality within world linguistics, to systematize the main research centers in this field, and to outline its principal directions. To achieve this, scientific articles, monographs, and corpus-based studies published in various countries have been comparatively analyzed.

It should also be noted that in the past decade, Azerbaijani linguistics has shown growing interest in this topic. S. T. Nuriyeva has published numerous articles devoted to the study of double modality.

Theoretical background

The Geographical Map of the Study of Double Modality in World Linguistics

The study of the phenomenon of double modality has primarily developed within the academic environments of English-speaking countries. In particular, the United States is considered one of the main centers of research in this field.

American linguists have mainly focused on the syntactic and semantic features of double modals used in the southern dialects of the country, analyzing the structure and functions of these constructions from the perspective of dialect syntax. For example, the linguist Athelstan Spilhaus has investigated double modality in Southern American dialects. (Hasty, J. D. 2012). Michael Montgomery has studied "regional dialects of America and double modality," Lisa Green has examined "African American English and modal structures," while the American linguist Douglas Biber has made a significant contribution to the study of corpus-based grammar. In addition, Walt Wolfram has explored double modality within the framework of "dialectology and non-standard syntax. Walt Wolfram's treatment of double modality is primarily reflected in his works *Appalachian Speech* (1976) and *American English: Dialects and Variation* (1998/2016). In these studies, he analyzes double modal constructions such as *might could* and *might should* as systematic grammatical features characteristic of Southern American and Appalachian dialects, emphasizing their role in expressing nuanced meanings related to possibility, ability, and speaker stance. A major strength of Wolfram's approach lies in his rejection of the view that such forms are "incorrect"; instead, he interprets double modality as a sociolinguistically valid and functionally meaningful structure, thereby contributing to a more objective and inclusive understanding of non-standard dialects. However, certain limitations can also be identified. His analysis is largely restricted to dialectal data and does not fully explore the functional-semantic potential of double modality within Standard English or written discourse. Furthermore, the semantic distinctions between different double modal combinations are not always systematically elaborated. Overall, while Wolfram's work provides a solid empirical and sociolinguistic foundation for the study of double modality, it also highlights the need for further investigation within broader theoretical and discourse-oriented frameworks (Wolfram & Christian, 1976; Wolfram, 1998/2016).

Research conducted in the United Kingdom, in contrast, has been more closely associated with dialectological and historical perspectives. British linguists have examined the historical development of double modals and their preservation in certain regional dialects. The research focus of Peter Trudgill has centered on British dialectology and regional varieties of English. Another British scholar, Jenny Cheshire, has investigated double modality within the framework of sociolinguistics and dialect syntax in the United Kingdom.

Among the studies carried out in the UK, two additional researchers occupy a prominent place: Joan Beal and David Britain. Joan Beal has focused on the dialects of Northern England, while David Britain has conducted research on regional variation and dialect syntax in British English. Furthermore, British scholars Bas Aarts, in his work on contemporary English grammar, and Geoffrey Leech, in his research on corpus linguistics and grammar, have contributed significantly to the study of modality as a broader category. (Aarts, 1998).

Since the 1980s, several linguists have played a key role in investigating modality from different theoretical perspectives, and their works have been fundamental for a deeper understanding of the phenomenon of double modality. F. R. Palmer's *Mood and Modality* (Palmer, 1986, 2001) is considered one of the foundational works in modality theory. Jennifer Coates's *The Semantics of Modal Auxiliaries* (1983) explores the semantics and combinations of modal verbs. Rodney Huddleston and Geoffrey Pullum, in *The Cambridge Grammar of the English Language* (2002), provide a comprehensive and detailed description of modal and semi-modal structures. (Huddleston, & Pullum, 2002).

Among German linguists, Bernd Kortmann has conducted research on World Englishes and syntactic variation, while Edgar W. Schneider has focused on grammatical variation within the framework of World Englishes. Angelika Kratzer, in her work *Modality* (1991), has established a profound theoretical foundation for the study of modal meaning, including double

and multiple modality. Jan Nuyts, in *Epistemic Modality, Language, and Conceptualization* (2001), offers a systematic analysis of epistemic modality, thereby further enriching the theoretical basis for the study of double modality.

The Finnish linguist Terttu Nevalainen has also made a significant contribution to the study of double modality. In her work on historical corpora and the development of the English language, she examines modality from a historical perspective, giving particular attention to its evolution over time.

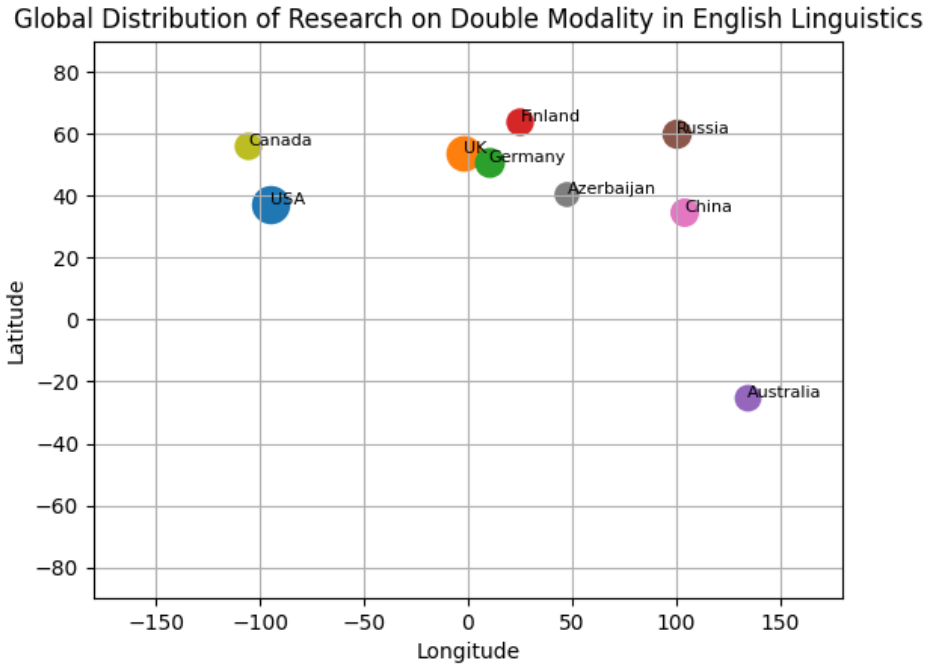
Research on double modality has also been carried out in countries such as Australia and Canada. These studies are generally situated within the broader framework of World Englishes and focus on determining whether double modality exists in different varieties of English, as well as on analyzing their functional characteristics from a comparative perspective.

In Azerbaijani linguistics, the analysis of double modality in English has also attracted increasing scholarly interest. S. T. Nuriyeva has conducted extensive research on this phenomenon, with particular emphasis on the use of double modality in Standard English. She has published numerous articles and conference papers on this topic, including the following works: *Double Modality as a Lexico-Grammatical Means of Expressing Future Tense in Modern English* (2019), *Inversion as a Means of Expressing Modality in Modern English* (2022), *New Approaches to Scientific Theoretical Ideas about the Part of Speech Called "Particle" in Modern English* (2024), *On the Comparative Analysis of the Category of Modality in English and Azerbaijani* (2023), *Componential Analysis of Double Modality* (2023), *From the History of the Study of Double Modality* (2024), *The Role of Periphrastic Modal Verbs in the Formation of Double Modality in Modern English* (2024), *Productive Means of Expressing Double Modality in Modern Standard English* (2025), *The Role of the Particle in the Formation of Double Modals in Standard English* (2025), *Ellipsis in the Syntax of Double Modality: A Syntactic Perspective* (2025), *Componential Analysis of Double Modality in Discourse* (2025), *Double Modality Beyond Modals: The Role of Mood and Inversion in Expressing Layered Modality in English* (2025), and *The Analysis of Double Modality in Discourse* (2026), among others.

The studies conducted by the linguists mentioned above have made it possible to examine various aspects of the phenomenon of double modality, that is, the broader category of modality, including dialect syntax, semantic and pragmatic features, as well as its use in corpus-based research.

In recent decades, interest in this linguistic phenomenon has also increased among scholars in Asian countries. Linguists working in this region have primarily focused on explaining the phenomenon from theoretical and typological perspectives, as well as on conducting research based on corpus data. Among the prominent representatives of the Russian linguistic school, Viktor Vinogradov, in his work *On the Category of Modality*, provided a classical interpretation of the category of modality, which continues to serve as a foundational framework for its study (Vinogradov, V. V., 1975). Another Russian linguist, Aleksandr V. Bondarko, examined modality within the framework of functional grammar in his work *Functional Grammar and Modality*. (Bondarko, A. V., 1990). Similarly, Aleksey D. Shmelev, in *Modal Meanings and Their Interpretation*, investigated modality and issues of multiple interpretation in discourse (Shmelev, A. D., 2002).

In Turkish linguistics, Aslı Göksel and Celia Kerslake, in their work *Turkish: A Comprehensive Grammar* (Göksel, A., & Kerslake, C.2005), analyze multi-layered modal structures in the Turkish language. Chinese linguists, who represent an important branch of the broader Asian linguistic tradition, have also made significant contributions to the study of modality. In particular, C.-T. James Huang, in *Modal Structures in Chinese Syntax*, and Wei-Tien Dylan Tsai, in *Multiple Modality in Chinese*, have examined double modality from a syntactic perspective. (Huang, C.-T. J. ,1998).



The map illustrates the geographical distribution of research on double modality in English linguistics. The size of each marker corresponds to the relative volume and influence of research conducted in the respective country. Major centers of research activity, such as the United States and the United Kingdom, are represented by larger markers, while other regions indicate developing or specialized contributions. The visualization is based on a comparative analysis of published studies, monographs, and corpus-based research.

Note:

It should be noted that this geographical map is relative, as it has been developed based on our investigation and reflects the findings obtained from our study.

The Stated Facts from a Critical Viewpoint

Although there are many studies on double modality, some important problems can be observed. Most research is mainly descriptive and focuses on identifying double modal forms in different dialects, but it does not always explain clearly how and why these forms function. In addition, more attention has been given to non-standard dialects, while double modality in Standard English has not been studied enough. Another limitation is the lack of comparative research across different languages, which makes it difficult to understand this phenomenon in a broader linguistic context. Even though corpus-based studies are increasing, their methods and results are not always consistent. For this reason, it is necessary to use a more integrated approach that combines syntax, semantics, pragmatics, and cognitive analysis in order to better understand double modality as a complex linguistic phenomenon.

Conclusion

The category of modality expresses the speaker's attitude toward the proposition and is studied in linguistics from this perspective. Modality is a multifunctional and structurally rich category. In English, it is expressed through a variety of lexical and grammatical means, and in some cases, the co-occurrence of two modal elements gives rise to double modality, which functions as a more complex and multi-layered means of expression.

Although double modality is more frequently observed in non-standard dialects of English, its semantic and pragmatic potential is not limited to the dialectal level. It enables the speaker to express multiple modal attitudes or shades of meaning simultaneously, thereby increasing the expressiveness of speech.

The geographical mapping of research on double modality demonstrates that this phenomenon was initially investigated within the framework of dialectological traditions in English-speaking countries. However, in recent years, it has attracted broader international scholarly interest. It has been established that the study of double modality began in the 1970s and has been actively pursued in countries such as the United States, the United Kingdom, Germany, Finland, Australia, Russia, and China.

It has also been observed that interest in double modality is growing within Azerbaijani linguistics, and research in this area contributes to the development of both theoretical and applied aspects of the field. In particular, studies focusing on the functional properties of double modality in Standard English are of significant importance.

Thus, double modality can be regarded as one of the increasingly prominent and relevant areas in modern linguistics, attracting attention within various theoretical frameworks. Future research should focus on the comparative analysis of this phenomenon across different languages, as well as on its discourse and cognitive dimensions.

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PHYSICS AND MATHEMATICS

THE ROLE OF TWIST IN THE LEMNISCATE CORE OF AN ELLIPSOIDAL VORTEX IN THE FORMATION OF THE PHASE SPACE OF THE SECOND KIND AND ITS RELATION TO MASS TRANSPORT CIRCULATION

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Abstract

A new concept of twisted vortex fields is introduced through an interpretation of the transport of matter circulation through the lemniscate core of an ellipsoidal vortex. The first case of the distribution of a stationary, non-twisted equipotential field is analyzed according to the rule of lemniscate separation of the phase spaces of vortex domains in an ellipsoidal vortex. The reason for the emergence of "two-sheeted" conformal planes of vortex fields under the condition of twist is explained. A parallel transport of the circulation of mass transfer along lemniscate strips is considered, characterizing the continuity of sliding flows while preserving the convective envelope (shell) of a closed ellipsoidal vortex. The interrelation between the curvature of the section $R_{\xi\eta}$ of the circulation Γ along a two-dimensional carrier region **Z** bounded by the vectors ξ and η with the kernel (core) shape of an ellipsoidal vortex is investigated.

Keywords: ellipsoidal vortex, conformal analysis of fields, vortex dynamics of substance, circulation vector, vortex interactions, curvature of the cross-section, lemniscate core, twisted field / helical field, curvature operator, kernel (core).

1. Introduction

A pencil of circles $\Theta = \gamma$ passing through the point $a + ib$ in the ***W*** - plane corresponds to a pencil of rectangular (equilateral) hyperbolas $\theta_1 + \theta_2 = \gamma$ passing through the pair of points $\pm(\alpha + i\beta) = \sqrt{a + ib}$ which correspond to an orthogonal family of confocal lemniscates in the **Z** - plane [1-2].

Both groups of curves under consideration represent families of orthogonal isotherms, which can be expressed by the following formulas:

$$lg\ p_1p_2 = c \text{ and } \theta_1 + \theta_2 = \gamma \qquad (1)$$

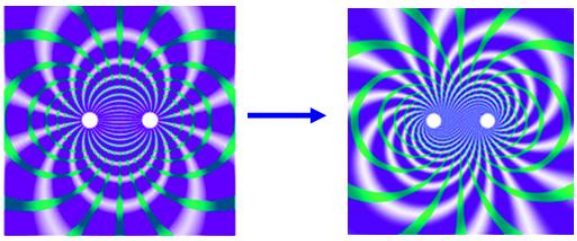
If c and γ take values of arithmetic progressions, the division is rectangular; with the same difference of the progressions it becomes quadratic. The latter case is shown in Fig. 1b.

The same lemniscate of the ***ω*** - plane can also be expressed in Cartesian coordinates (under the mapping $z = \sqrt{\omega}$)

$$\frac{1}{2}\left[lg\{(x-\alpha)^2 + (y-\beta)^2\} + lg\{(x+\alpha)^2 + (y+\beta)^2\}\right] = c \qquad (2)$$

$$arctan\frac{y-\beta}{x-\alpha} + arctan\frac{y+\beta}{x+\alpha} = \gamma$$

where, when imaginary numbers are substituted into the left-hand side of equation (3), the Laplacian remains unchanged, $\Delta u = 0$.



a *b*

Fig. 1: Transformation of the distribution of a "stationary" equipotential field into another "curved" field when the lemniscate is rotated by 180° between the two foci [2].

The physical interpretation of this picture is explained by the fact that the lemniscate line passes along the boundary separating the "phase spaces of vortex domains" and represents "isotherms" where the difference between the opposite "phase" spaces remains constant. The lemniscate itself obeys a complex law of circulation.

$$a + ib = i\ \frac{\Gamma}{2\pi} = \frac{z}{|z|^2} = \frac{i}{2\pi}\sum_{\alpha=1}^{N}\Gamma_\alpha\frac{z-z_a}{|z-z_a|^2} \qquad (3)$$

In two figures (Fig. 1) it can be seen that, depending on how the two "propellers" (the two focal points) interact with each other, the magnitude of the torque changes. This torque is proportional to the sum or the difference of the two circulations Γ_1 and Γ_2.

$$M_d = \dot{m}(r_1C_{1\varphi} - r_2C_{2\varphi}),\ \Gamma_1 = 2\pi r_1C_{1\varphi},$$
$$\Gamma_2 = 2\pi r_2C_{2\varphi}, M_a = \frac{\dot{m}}{2\pi}(\Gamma_1 \pm \Gamma_2)\ , \qquad (4)$$

where M_d is the dynamic moment, $\dot{m}$ is the mass flow rate, M_a is the moment determined by the circulations Γ_1 and Γ_2, $C_{1\varphi}$ and $C_{2\varphi}$ are the tangential velocities.

From Fig. 1a it can be seen that, under the symmetric influence of two "sources" located at the foci, a regular distribution is formed: namely, an orthogonal distribution of the potential, perpendicular to the segment $|A_1A_2|$ between the points A_1 (the center of circulation Γ_1) and A_2 (the center of circulation Γ_2). These points lie at the foci of the lemniscate (and of the ellipse as well).

$$\frac{A_1+A_2}{2}+\sqrt{\left(\frac{A_1+A_2}{2}\right)^2+1}=e^c \text{ or} \frac{A_1+A_2}{2}=\frac{e^c-e^{-c}}{2}, \quad (5)$$

where

$$arc\cos\frac{A_1-A_2}{2}=c \text{ or} \frac{A_1-A_2}{2}=Cos\ c \quad (6)$$

It denotes the inclination of the semi-axis or asymptote c. From equation $\zeta=(z+\sqrt{z^2+1}\,)$ (7), for $c=1$, we obtain [2]:

$$z=X+iY=\frac{1}{2}(\zeta+\zeta^{-1}) \quad (8)$$

Hence, for the mapping function (Fig. 1a), we find:

$$\begin{cases} X=\frac{x(x^2+y^2+1)}{(x^2+y^2)}=\frac{1}{2}(\zeta+\zeta^{-1})\ Cos\ \varphi \\ Y=\frac{y(x^2+y^2-1)}{(x^2+y^2)}=\frac{1}{2}(\zeta-\zeta^{-1})\ Sin\ \varphi \end{cases} \quad (9)$$

For $X=a$ and $X=b$, the result of the field interaction is shown in Fig. 1a. For $Y=0$, we obtain a circle of unit radius (Fig. 3b, the conformal case). From equations (9), we obtain the following:

$$\frac{X}{Cos\ \varphi}=\frac{1}{2}(\zeta+\zeta^{-1}),\frac{Y}{Sin\ \varphi}=\frac{1}{2}(\zeta-\zeta^{-1}) \quad (10)$$

From this, we obtain a new equation:

$$\frac{1}{4}(\zeta+\zeta^{-1})^2-\frac{1}{4}(\zeta-\zeta^{-1})^2=1 \quad (11)$$

Thus, we have

$$\frac{X^2}{Cos^2\varphi}-\frac{Y^2}{Sin^2\varphi}=1 \quad (12)$$

The straight line $\varphi=\gamma$ passing through the zero point of the ζ- plane corresponds to a hyperbola in the Z-plane. Its semi-axes a and b have the ratio:

$$a^2+b^2=Cos^2\varphi+Sin^2\varphi=1, \quad (13)$$

Therefore, the foci are located at the focal points $+1$ and -1 on the OX axis, and γ represents the inclination of the asymptote.

In the second case (Fig. 1b), a different lemniscate interaction between the two points $\boldsymbol{A_1}$ and $\boldsymbol{A_2}$ appears. Here we deal with a special "twisted" field formed between two points possessing different spin. In this situation, the field rotates by 45°, and along the axis of the "poles", passing through the center of the white lines, each loxodromic–lemniscate curve passes. These curves arise from the antisymmetric interaction of two different foci. At the same time, each curve is arranged so that it does not obstruct another line from passing through it freely, as shown in Fig. 2.

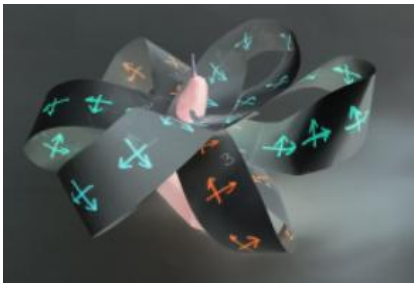
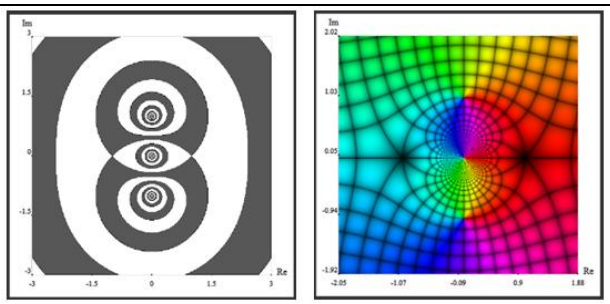


Fig. 2. Reconstruction of function (64) from [2] from a conformal mapping into three-dimensional space according to the lemniscate law of strips - "flat" vortex filaments of an ellipsoidal vortex. A more detailed description of the lemniscate law is given in Chapter 4 of [2]. The twist of each strip is 180° [2–5].

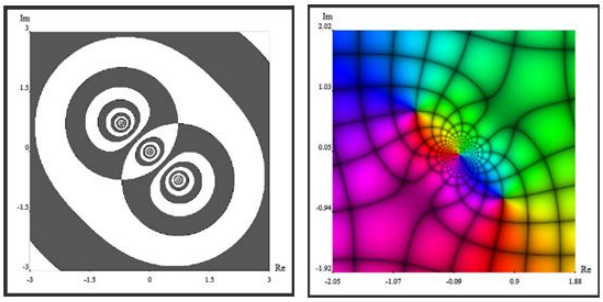
Here, due to the double inverted shift of the field on the Z-plane by an angle α, the lemniscate plane appears to split into four equivalent sheets. In this case, the principle of inverse mapping in conformal geometry comes into operation. A more detailed discussion can be found in works [2, 3, 5]. The point $\boldsymbol{O}$ behaves as a special isolated point. The lines passing through this point are perpendicular to each other and slide over one another. On the imaginary axis passing through $\boldsymbol{O}$ (there are the same special isolated points $\boldsymbol{O_1}$ and $\boldsymbol{O_2}$, which characterize those very lines.). If one looks at the plane in Fig. 1b from above, a double parallel independent shift of the lines by 45° becomes visible. One shift is directed to the right on one sheet, while the other is directed to the left on the other sheet. This geometry of rotations does not resemble helical geometry and therefore requires proper consideration.

2. Twisted External Field (Conformal Analysis)



a *b*

Fig. 3 (Conformal analysis of Fig. 1a - the "regular ellipsoidal field"): a) the potential field; b) its isogonal lines. Here the calculation was performed according to formula (8) [2].



a *b*

Fig. 4 (Conformal analysis of Fig. 1b — the curved ("twisted") field): a) its potential field, rotated by an angle of 45°; b) its isogonal field lines. It is noteworthy that along the axis passing through the center of the poles, its "wings" become visible. From this, the dynamics of matter motion can be observed based on the analysis of the colored domains [2].

The question of the existence of the lemniscate image was studied by Lindemann and Volk [6–8]. However, unlike Lindemann's work, Volk focused his attention only on the lemniscate itself and its internal structures. Here, we can extend the scope of the analysis by introducing one important formula that expresses a complex mapping (conformal transformation) between the complex variables ζ and z. This formula represents the transition from one complex coordinate system to another and is often used to orthogonalize families of curves or fields:

$$z = (i\zeta - \zeta^{-1})/2\,. \qquad (14)$$

(These functions are directly related to the orthogonalization of superimposed external fields. A more detailed discussion can be found in works [2, 5]).

Above are two figures (Fig. 3 and Fig. 4) showing how significantly the external resultant field can change if the first one is rotated by 45°.

3. On the Role of Sectional Curvature in the Transport of the Circulation Vector

In this section, we consider the role of the sectional curvature $R_{\xi\eta}$ in forming a specific distribution pattern of circulation within the microvortex core (at the tip of the core).

When transitioning from a surface of negative curvature during the detachment of a droplet–microvortex from the core of the main spherical vortex, the angular momentum and the spin of the detached microvortex, together with the circulation vector of the substance within it, are conserved [2, 3, 5].

The role of the sectional curvature $R_{\xi\eta}$ in the transport of the circulation vector can be explained as follows.

Let two mutually perpendicular directions ξ and η, be considered in the core of an ellipsoidal microvortex, defining a small two-dimensional area in the tangent space. The transport of the circulation vector along one direction and then along the other, in the general case, does not coincide with the transport performed in the reverse order. It is precisely this non-coincidence that characterizes the curvature of the region under consideration.

If the flow space is locally flat, then the parallel transport of the circulation vector along a small closed contour does not change its orientation. However, in the presence of sectional curvature, an additional rotation of the vector appears after traversing such a contour. Therefore, sectional curvature determines the extent to which the geometry of the vortex core influences the change in the direction of circulation during its transport.

This statement is expressed through the curvature operator

$$R_{\xi\eta} = -\langle\nabla_\xi\nabla_\eta\xi,\eta\rangle + \langle\nabla_\eta\nabla_\xi\,\xi,\eta\rangle + \langle\nabla_{[\xi,\eta]}\xi,\eta\rangle, \qquad (15)$$

where $[\xi,\eta]$ is the Lie bracket of the vector fields ξ and η, whose restrictions to the vortex cell at z are $\xi(z)$ and $\eta(z)$, respectively.

The scalar product of this expression with η gives the sectional curvature in the plane spanned by ξ and η:

$$R_{\xi\eta} = \langle R(\xi,\eta)\xi,\eta\rangle\,, \qquad (16)$$

here $R(\xi,\eta)$ is the curvature operator (the Riemann tensor), ξ and η are two mutually orthogonal tangent vectors, and $\langle\cdot,\cdot\rangle$ denotes the scalar product. It follows that the quantity $R_{\xi\eta}$ represents the measure of deviation of the circulation vector from its initial direction during its successive transport along two independent

directions. In other words, the sectional curvature quantitatively describes the local geometry of the twist of the flow.

For a vortex core, this is particularly important because the transport of circulation occurs not in an arbitrary region but in a domain with a pronounced spiral structure of streamlines. In such a geometry, the sectional curvature determines the coherence of the rotational motion of neighboring layers of the medium. If $R_{\xi\eta}$ preserves its sign and changes smoothly, the transport of circulation remains ordered, and the vortex core maintains a stable structure. However, if the curvature changes abruptly, this leads to a local redistribution of circulation, deformation of trajectories, and a possible loss of stability of the vortex core.

Thus, sectional curvature plays the role of a geometric mechanism that regulates the transport of the circulation vector inside a microvortex. It determines how strongly the transport depends on the shape of the local vortex surface, thereby influencing the stability, ordering, and spatial separation of flows in the core region.

Here, the sectional twist during the cross-section plays an important role in the detachment from the core of the ellipsoidal vortex. From Fig. 5, a clear separation of flows according to the law of helical surfaces can be observed, which allows the structure to remain in a stable equilibrium state as long as the vortex core exists. A more detailed description of the core is given in the following works [2, 3, 5]. Thus, such a "formed" closed spiral conical surface (which unites all spiral lines within the funnel) characterizes the formation of a funnel with a core of the shape shown in Fig. 5. This configuration never allows unnecessary interactions between flows located on opposite sides of this spiral–lemniscate–helical surface This surface differs significantly from the simple helical surface of the Riemann type (see Sections 6.2–6.4 [2]), since it can be seen that the geodesic vortex lines pass freely both along the lines of the external spherical оболочка (shell) and along the spiral lines inside a single cone-core, up to the moment of detachment from the tip of this cone-core.

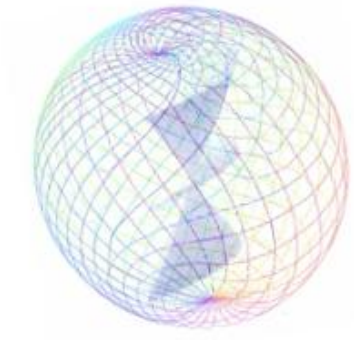


Fig. 5. Longitudinal view of the unfolded cone of the funnel forming the core of an ellipsoidal vortex. It can be seen that the plane passing through the center of the core divides it into two halves [2–4]. Due to such a surface configuration, this structure does not allow two different flows from opposite poles to mix with each other.

4. Dimensionality of the sectional curvature

For a physical interpretation, it is convenient to relate the sectional curvature not to an abstract tensor but to the characteristic radius of twist of the vortex core and the angular velocity of rotation.

If $R_{\xi\eta}$ satisfies condition (16), then after normalizing ξ and η to unit vectors, the sectional quantity has the dimension $[R_{\xi\eta}] = 1/m^2$. That is, it is a quantity of the order $R_{\xi\eta} = 1/a^2$ (17), where a is the characteristic radius of curvature of the vortex surface or the radius of the micro-vortex core. In other words, the smaller the radius of the core, the larger the sectional curvature.

5. Relation Between Sectional Curvature and the Radius of the Vortex Core

If locally the stream surface in the micro-vortex core is assumed to be close to a surface with a radius of curvature a, then the estimate takes the form:

$$R_{\xi\eta} = \pm\, 1/a^2\,. \qquad (18)$$

The sign depends on the geometry: (i) $R_{\xi\eta} = +\,1/a^2$ if the structure is locally sphere-like; (ii) $R_{\xi\eta} = -\,1/a^2$ if the structure is saddle-shaped, hyperbolic; (iii) $R_{\xi\eta} = 0$ if the region is locally flat. For our case, where we are dealing with the detachment of a droplet–microvortex and a surface of negative curvature, it is natural to write the condition for the detachment of matter from the tip of the vortex as follows:

$$R_{\xi\eta} = -\,1/a^2\,. \qquad (19)$$

This means that it is precisely the saddle geometry that promotes the divergence of nearby trajectories and the separation of a droplet–microvortex from the main core.

6. Relation of $R_{\xi\eta}$ with the circulation Γ and the velocity v_θ

For an axisymmetric vortex, the velocity at a distance r from the axis is usually estimated as:

$$v_\theta = \Gamma/2\pi r. \qquad (20)$$

At the boundary of the core, $r \sim a$, then

$$v_\theta = \Gamma/2\pi a\,. \qquad (21)$$

From that we get

$$\Gamma \sim 2\pi a v_\theta\,. \qquad (22)$$

If the radius is expressed in terms of the circulation and the characteristic tangential velocity, we obtain:

$$R_{\xi\eta} \sim 1/a^2 \sim 4\,\pi^2 v_\theta^2/\Gamma^2 \qquad (23)$$

That is, the sectional curvature can be estimated as follows:

$$R_{\xi\eta} \approx \pm\, 4\,\pi^2 v_\theta^2/\Gamma^2 \qquad (24)$$

For a region of negative curvature, we have:

$$R_{\xi\eta} \approx -\,4\,\pi^2 v_\theta^2/\Gamma^2 \qquad (25)$$

From equations (20–25) the following interesting conclusions follow: (i) the greater the tangential velocity v_θ, the stronger the local twist and the larger the magnitude of the curvature; (ii) the greater the circulation Γ, the larger the characteristic size of the vortex and the smaller the magnitude of the curvature; (iii) the smaller the core radius a, the more strongly the vortex surfaces are curved.

In other words, sectional curvature indicates **how tightly the vortex core is twisted.**

7. Conclusions

The performed analysis shows that the geometry of lemniscate structures and the conformal mappings associated with them play an important role in describing the distribution of potential and vortex fields. A pencil of circles in the **W**-plane passing through a fixed point, under the mapping, generates a family of equilateral hyperbolas in the **Z**-plane, which turns out to be orthogonal to the family of confocal lemniscates. These two systems of curves form an orthogonal network of isotherms, allowing the field to be described by harmonic functions satisfying the Laplace equation.

It is shown that the geometry of such lines is directly related to the physical interpretation of vortex processes. The lemniscate acts as a boundary separating the phase regions of the vortex field, where a constant difference of phase potentials is maintained. Within the framework of the complex law of circulation, the field distribution is determined by the interaction of several centers of circulation, which leads to the formation of different field configurations—from a symmetric potential distribution to "twisted" structures arising from the antisymmetric interaction of the foci.

The conformal analysis made it possible to establish a connection between the geometry of the field lines and their physical interpretation. In particular, it is shown that straight lines on the auxiliary plane are mapped into hyperbolas on the physical plane, and their parameters determine the positions of the foci and the inclination of the asymptotes. This makes it possible to describe complex field structures through relatively simple analytical relations.

Special attention is given to the role of sectional curvature in the transport of the circulation vector within the microvortex core. Sectional curvature acts as a geometric characteristic that determines the change in orientation of the circulation vector when it is transported along different directions in the tangent space of the flow. In regions of negative curvature, a natural mechanism arises for the divergence of nearby trajectories, which facilitates the detachment of a droplet–microvortex from the main vortex core.

A relationship has been obtained between the sectional curvature, the radius of the vortex core, the tangential (circumferential) velocity, and the circulation. It is shown that the magnitude of the curvature increases as the core radius decreases and the tangential velocity increases, whereas an increase in circulation leads to an increase in the characteristic scale of the vortex and a corresponding decrease in curvature. Thus, the sectional curvature can be regarded as a quantitative measure of the degree of twist of the vortex core.

In general, the conducted study demonstrates that the use of methods of conformal geometry and curvature analysis makes it possible to obtain a comprehensive understanding of the structure of three-dimensional vortex fields, the mechanism of formation of lemniscate boundaries, and the conditions for the stability of the vortex core. This creates a basis for further research into the dynamics of microvortices, the processes of separation of vortex structures (domains), and their interactions in complex flows.

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POLITICAL SCIENCES

KAZAKHSTAN'S DIGITAL SOVEREIGNTY MODEL: A SECURITY–DEVELOPMENTAL APPROACH IN COMPARATIVE PERSPECTIVE

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DOI: 10.5281/zenodo.19491385

Abstract

Digital sovereignty has become a central concept in global debates on technology, governance, and power. While existing scholarship focuses primarily on the models advanced by the European Union, the United States, and China, less attention has been paid to emerging middle powers. This article examines Kazakhstan's approach to digital sovereignty and argues that it represents a distinct **security–developmental model**, characterised by a strong emphasis on cybersecurity, state control over data flows, and state-led innovation oriented toward national development rather than market dominance or normative regulation. Using a qualitative-quantitative coding analysis of key Kazakhstani policy documents, the article shows that cybersecurity and resilience form the core of Kazakhstan's digital sovereignty discourse, while platform regulation and rights-based governance play a secondary role. In comparative perspective, Kazakhstan's model differs from the regulatory sovereignty of the European Union, the market-driven model of the United States, and China's state-centric data control regime. The findings contribute to understanding digital sovereignty as a concept that takes diverse forms beyond major global powers.

Keywords: digital sovereignty, Kazakhstan, cybersecurity, data governance, innovation policy, comparative digital governance, middle powers, developmental state.

Introduction

Digital sovereignty has become a central concept in contemporary international relations. As states seek to assert control over digital infrastructure, data flows, and technological systems, the concept has moved from academic discourse into core policy agendas. For a time, the literature focused primarily on large, technologically capable states — the United States, China, and the European Union — while the strategies of smaller and developing states received comparatively little attention.

Kazakhstan offers a useful case for expanding this focus. It does not pursue global digital dominance, nor does it seek to shape international norms through technological leadership. Its approach to digital sovereignty is instead shaped by concerns over national security, infrastructural resilience, and state-directed modernisation. These are conditions typical of many middle-income developing states operating under external technological dependence and geopolitical pressure.

This article asks: what form does digital sovereignty take in Kazakhstan, and how does it differ from the approaches of major powers? The article argues that Kazakhstan has developed a **security–developmental model of digital sovereignty**, in which cybersecurity and resilience form the central priority, supported by state-directed innovation and controlled data governance. Rights-based regulation and platform competition occupy a secondary role. By coding Kazakhstan's core digital policy documents and situating the findings in a broader comparative framework, the article extends existing theories of digital sovereignty beyond the experience of major powers.

2. Conceptual Framework: Digital Sovereignty Beyond Major Powers

Digital sovereignty lacks a settled definition. Scholars have variously emphasised its legal, technological, economic, and security dimensions. As a policy concept, it refers broadly to a state's ability to apply an authority over the digital infrastructure, data, and technologies within its jurisdiction (Chander and Sun, 2021). In the existing literature, three dominant national models can be identified [1].

The **EU's regulatory model** centres on rights protection, platform regulation, and normative governance. Key instruments include the General Data Protection Regulation (GDPR) and the Digital Services Act (DSA). Sovereignty is exercised primarily through legal authority and regulatory reach, reflecting what Bradford (2020) has called the "Brussels Effect": the capacity to set binding standards that extend beyond EU borders [2].

The **US market-driven model** is characterised by private-sector leadership and technological innovation. Digital sovereignty is defined less by federal regulation than by control over leading platforms, standards, and innovation ecosystems. State power operates through the structuring of global markets and supply chains rather than direct regulatory intervention [3].

China's state-centric model combines strong control over data flows, digital infrastructure, and online content with an explicit geopolitical dimension. Digital sovereignty serves both as an internal governance instrument — maintaining party-state control over the information environment — and as a basis for external influence through infrastructure investment and technology export [4].

These three models can be organised into a simple typology along two dimensions: the degree of state intervention and the primary orientation of sovereignty (rights-normative vs. security-developmental). Table 1 summarises this classification and adds a fourth type corresponding to the middle-power pattern explored in this article.

Table 1.

A typology of digital sovereignty models

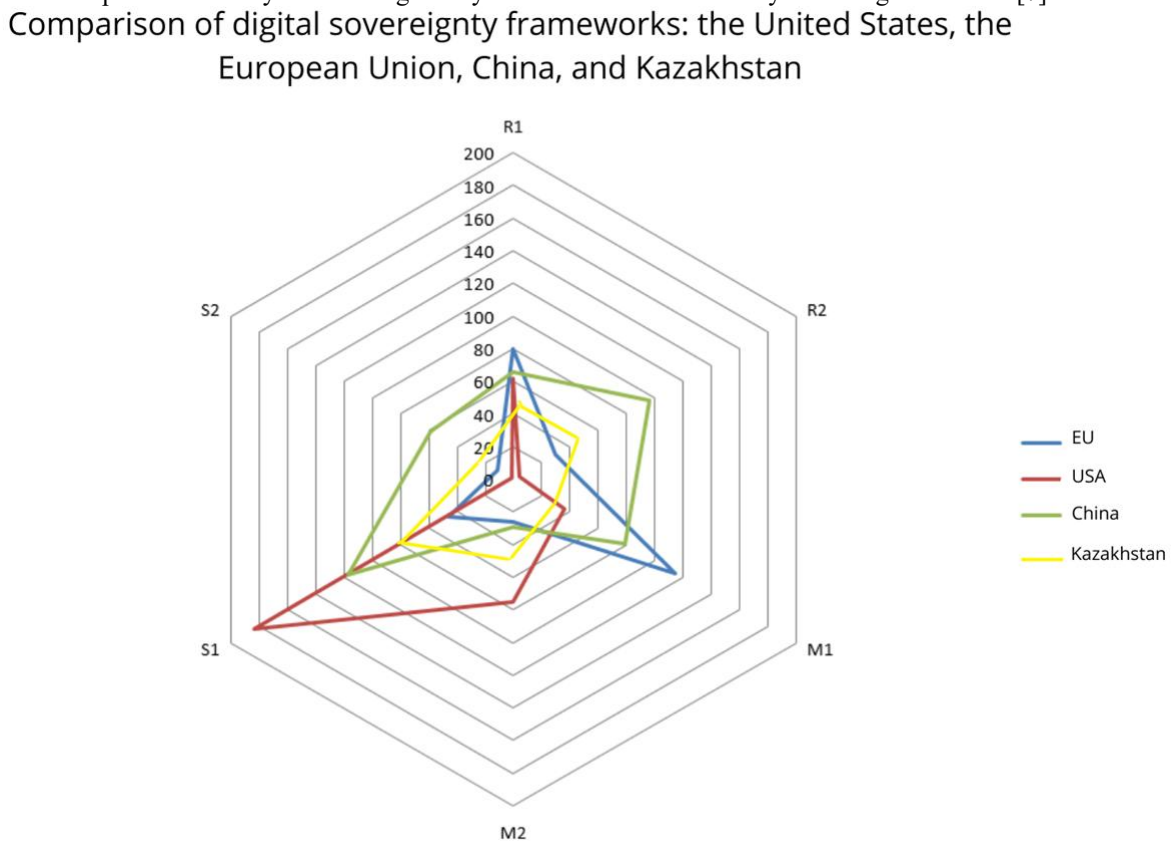
Model	State Intervention	Primary Orientation	Example
EU (Regulatory)	Moderate–High	Rights and normative governance	GDPR, DSA
US (Market)	Low	Innovation and market competitiveness	Platform ecosystems
China (Statist)	High	Security and geopolitical control	PIPL, GFW
Kazakhstan (Security-developmental)	Moderate	Resilience and developmental modernisation	Middle powers

These three dominant models, however, were developed primarily around the experience of technologically capable and geopolitically influential states. For states with more limited technological capacity, constrained global influence, and significant external dependencies, digital sovereignty takes a different form. This is consistent with what Evans (1995) describes in the developmental state literature: state-led coordination of economic and technological transformation within a security-constrained environment [5].

Middle-power and emerging states face a specific structural position — they lack the regulatory reach of the EU, the platform power of the US, or the geopolitical leverage of China, yet face comparable digital risks. For such states, digital sovereignty tends to be defensive, inward-oriented, and tied to national stability rather than global influence. Kazakhstan fits this profile [6].

Analytical Dimensions

The coding framework used in this study draws on existing typologies in digital sovereignty research and on the typology above. It is organised around six dimensions, each capturing a distinct aspect of how states assert authority in the digital domain [7]:



– **S1 – Cybersecurity and resilience**: references to protecting critical infrastructure, responding to cyber threats, and maintaining state digital systems
– **R1 – Rights and data protection**: references to individual privacy, data subject rights, and personal data regulation
– **R2 – Control over data flows**: references to data localisation, oversight of data transfers, and national data sovereignty
– **M1 – Platform and competition regulation**: references to regulating digital platforms, market dominance, and competition
– **M2 – Innovation and technological base**: references to digital development, AI, e-government, and building technological capacity
– **S2 – Additional sovereignty dimensions**: governance capacity, digital skills, and institutional development

These categories overlap in practice: a single policy measure may address more than one dimension. Their relative prominence across the analysed documents provides an empirical basis for identifying Kazakhstan's priority areas.

3. Methodology and Data

The analysis is based on qualitative-quantitative coding of Kazakhstan's key digital policy documents, including:
– the *Digital Kazakhstan* programme
– legislation on information security, informatisation, and digital assets
– the Law on Personal Data and Their Protection
– the Cybersecurity Concept *Cyber Shield of Kazakhstan*
– the Concept for the Development of Artificial Intelligence (2024–2029)

The paragraph was used as the primary unit of analysis. Each paragraph was coded for its dominant thematic content according to the six dimensions described above, with multiple codes applied where a paragraph addressed more than one dimension. Coding was conducted by the author, with a second-pass review to ensure consistency across documents and categories. The frequency counts reported below reflect the number of coded paragraphs per category across the full document set.

It should be noted that frequency data indicates relative thematic emphasis rather than conclusive structural dominance. High frequency of a category reflects the pervasiveness of that theme in the documents, not a direct claim about causal or hierarchical primacy. The quantitative results are therefore interpreted alongside a qualitative analysis of how each category functions within the broader policy logic of the documents. This study also treats the document set as a synchronic snapshot of Kazakhstan's digital sovereignty priorities; it does not track changes over time.

4. Kazakhstan's Digital Sovereignty Model

Cybersecurity and resilience (S1) is the most frequently coded dimension, with 81 references across the analysed documents. This reflects a deliberate strategic choice: in Kazakhstan's policy framework, digital transformation and national security are treated as inseparable concerns. Documents such as the Cyber Shield of Kazakhstan conceptualise the digital domain primarily as a space of vulnerability, where threats to information systems, critical infrastructure, and government networks are framed as direct challenges to state sovereignty [8].

The high frequency of S1 references indicates that security concerns pervade Kazakhstan's digital policy. It should be noted, however, that frequency alone does not establish structural dominance. The qualitative analysis below suggests that security framing also shapes how other dimensions — particularly data governance and innovation — are articulated, which is what gives S1 its central role in the overall policy logic.

Kazakhstan does not treat cybersecurity as a technical sub-field of policy. Instead, cyber threats are presented as factors capable of destabilising public order and institutional function. As a result, digital sovereignty is articulated primarily as an extension of national security policy, rather than as an outgrowth of market regulation or individual rights protection.

Control over Data Flows: Defensive Sovereignty

Control over data flows (R2) is coded 44 times, making it the second most prominent dimension. Data governance in Kazakhstan is framed primarily through the lens of regulatory oversight and national information security, particularly in sectors connected to public administration, critical infrastructure, and strategic industries.

Unlike models where data sovereignty serves as a geopolitical instrument or tool of economic coercion, Kazakhstan's approach is defensive and inward-oriented. Data localisation requirements and oversight mechanisms are designed to limit exposure to foreign legal jurisdiction, external surveillance, and infrastructural dependence [9].

This distinguishes Kazakhstan from China's model, where control over data is closely tied to international digital competition. In Kazakhstan, data sovereignty performs a stabilising function within a context of limited autonomy and asymmetric interdependence.

Innovation as State-Led Development

Innovation and the technological base (M2) is coded 46 times. Programmes such as Digital Kazakhstan and the AI Concept (2024–2029) give significant weight to advanced technologies, digital public services, and automation for national development. The framing of innovation here, however, differs markedly from that in major technological powers.

Innovation is not linked to global platform expansion or competitive leadership in international markets. It is instead understood as a tool of state-led modernisation: AI, data-driven governance, and digital infrastructure are valued primarily for improving administrative efficiency, public service delivery, and economic diversification. Innovation therefore serves a developmental function, embedded within a broader strategy of state capacity-building.

This reflects Kazakhstan's structural constraints. Lacking the industrial base and private-sector ecosystems needed to compete with dominant technological actors, the state takes on the primary role in driving digital development. Digital sovereignty here does not imply technological self-sufficiency or global leadership, but rather the capacity to selectively adopt and govern

technologies in line with national development goals and security requirements [10].

Secondary Role of Rights and Platform Regulation

Rights and data protection (R1) appears 48 times, but does not function as a normative foundation of digital sovereignty. Unlike in the EU, where individual rights form the basis of digital governance, Kazakhstan treats data protection primarily as an administrative and regulatory requirement. Legal provisions on personal data are embedded within broader frameworks of informatisation and information security, rather than articulated as independent political principles.

Platform and competition regulation (M1) is the least prominent dimension, with only 13 references. Digital platforms are treated as components of the broader digital ecosystem operating within state-defined boundaries, rather than as independent actors requiring targeted governance. This reflects both the absence of large domestic digital platforms and the dominance of foreign providers, which reduces the perceived urgency of platform-specific regulation as a sovereignty instrument [11].

Comparative Perspective

Kazakhstan's digital sovereignty model differs in important ways from those of major global actors. The EU prioritises rights-based regulation and normative rule-setting as the primary means of asserting sovereignty — a logic largely absent from Kazakhstan's framework. The US relies on private-sector innovation and platform power, which Kazakhstan lacks the structural conditions to replicate. China deploys digital sovereignty as a geopolitical instrument aimed at both internal control and external expansion — a goal that Kazakhstan, given its scale and regional position, neither pursues nor sustains.

Kazakhstan instead represents a security–developmental model: sovereignty defined by the state's capacity to protect critical infrastructure, control sensitive data flows, and guide technological development in line with stability and modernisation goals. This reflects the conditions common to emerging states operating under external technological dependence and limited global influence.

It should be noted that this comparison relies primarily on secondary literature rather than equivalent primary document coding for the EU, US, and China. A fully symmetrical comparison would require applying the same coding framework to comparable policy corpora from each jurisdiction, which lies beyond the scope of this study. The comparison is therefore indicative and intended to contextualise Kazakhstan's approach rather than to establish formal equivalence.

Conclusion

Kazakhstan's approach to digital sovereignty does not fit neatly within any of the three dominant models in the existing literature. Its core priorities — cybersecurity, controlled data governance, and state-led innovation — reflect the constraints and goals of a developing state under external technological pressure, rather than those of a major regulatory, market, or geopolitical power.

The article's main theoretical contribution is to show that digital sovereignty is context-dependent. It is shaped by a state's technological capabilities, security exposure, and developmental priorities. For emerging states, sovereignty in the digital domain is less about asserting global influence than about reducing vulnerability, managing external dependence, and preserving decision-making capacity under conditions of asymmetric interdependence.

This analysis also challenges implicit hierarchies in the existing literature, where digital sovereignty is often presented as a progression toward either the EU's regulatory model or China's state-centric model. The Kazakhstani case shows that sovereignty in the digital age can be pursued pragmatically — through selective control, securitisation of critical domains, and coordinated state investment — without aspiring to technological self-sufficiency or global norm-setting power.

Future research should examine the digital sovereignty strategies of other middle-power and developing states, particularly in Central Asia, where digital transformation unfolds under conditions of geopolitical competition and infrastructural dependence. Comparative work applying equivalent coding methods to other states would allow for more systematic cross-national conclusions and would contribute to a more inclusive theory of digital governance.

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TECHNICAL SCIENCES

ФИЗИКО-ХИМИЧЕСКИЕ И МИКРОБИОЛОГИЧЕСКИЕ ПОКАЗАТЕЛИ РЫБНЫХ КОТЛЕТ ИЗ МАЛОЦЕННЫХ ВИДОВ РЫБ

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PHYSICOCHEMICAL AND MICROBIOLOGICAL CHARACTERISTICS OF FISH CUTLETS FROM UNDERUTILIZED FISH SPECIES

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Аннотация

В статье представлены результаты исследования физико-химических и микробиологических показателей рыбных котлет, изготовленных из пяти малоценных видов рыб: воблы, сазана, леща, карася и жереха. Определяли массовую долю белка, жира и количество мезофильных аэробных и факультативно-анаэробных микроорганизмов (КМАФАнМ). Установлено, что содержание белка варьировало от 9,85 % до 15,06 %, а жира — от 2,78 % до 5,35 %, что отражает различие пищевой ценности исходного сырья. Уровень КМАФАнМ всех образцов находился значительно ниже допустимого значения по нормативной документации (2,5 × 10^3 КОЕ/г), что свидетельствует о высокой санитарной безопасности продукции. Полученные результаты подтверждают целесообразность использования малоценных видов рыб для производства котлет, расширение сырьевой базы и обеспечение продовольственной безопасности населения.

Abstract

The article presents the results of a study on the physicochemical and microbiological characteristics of fish patties produced from five underutilized fish species: roach, common carp, bream, crucian carp, and asp. The mass fractions of protein and fat, as well as the total viable count (TVC), were determined. It was found that the protein content ranged from 9.85% to 15.06%, while the fat content varied from 2.78% to 5.35%, reflecting differences in the nutritional value of the raw materials. The TVC values of all samples were significantly lower than the permissible limit established by regulatory documentation (2.5 × 10^3 CFU/g), indicating high sanitary safety of the products. The results obtained confirm the feasibility of using underutilized fish species for the production of fish patties, contributing to the expansion of the raw material base and ensuring food security.

Ключевые слова: рыбные котлеты, малоценные виды рыб, фаршевые изделия, физико-химические показатели, микробиологические показатели, массовая доля белка, массовая доля жира, КМАФАнМ, качество продукции, безопасность пищевых продуктов.

Keywords: fish patties, underutilized fish species, minced fish products, physicochemical characteristics, microbiological characteristics, protein content, fat content, total viable count, product quality, food safety.

Введение

В последние годы наблюдается рост интереса к изделиям из рыбного фарша, таким как рыбные котлеты, которые пользуются спросом благодаря удобству, доступности и хорошим органолептическим свойствам. На текущий момент количество и оснащенность рыбообрабатывающих комплексов позволяет использовать малоценные виды рыб, которые обычно не используется в пищевых целях и направляется на кормовые нужды. Использование изделий из малоценных видов рыб позволит расширить сырьевую базу и обеспечить продовольственную безопасность населения.[1]

В то же время при переработки малоценных видов рыб особое значение играет оценка качества и безопасность готовой продукции. Физико-химические показатели позволят судить о пищевой ценности продукта, тогда как микробиологические позволят характеризовать его санитарное состояние.

В связи с этим актуальной целью становится исследование физико-химических и микробиологических показателей рыбных котлет, изготовленные из различных малоценных видов рыб.

Материалы и методы

Объектом исследования являлись жареные рыбные котлеты из 5 малоценных видов рыб такие как: вобла, сазан, карась, лещ, жерех.

Рыбные котлеты готовили по следующей рецептуре: рыбный фарш смешивали с водно-крахмальной смесью с добавлением соли, сахара, перца, чеснока и растительного масла. Полученную массу перемешивали в течение 15 минут до образования однородной структуры. Затем из фарша формировали котлеты, которые погружали в льезон, состоящий из воды и муки, после чего удаляли его излишки и панировали изделия в сухарях. Сформированные полуфабрикаты подвергали термической обработке (жарке) до готовности.

После приготовления отбирали образцы, которые направляли в исследовательскую лабораторию для проведения анализа физико-химических и микробиологических показателей. В ходе исследования определяли массовую долю белка, массовую долю жира, а также количество мезофильных аэробных и факультативно-анаэробных микроорганизмов (КМАФАнМ). Испытания проводили в соответствии с требованиями нормативных документов: ГОСТ 25011–2017, ГОСТ 23042–2015 и ГОСТ 10444.15–94. [2,3,4]

Результаты и обсуждение

В ходе проведённых исследований были определены физико-химические и микробиологические показатели рыбных котлет, изготовленных из различных малоценных видов рыб. Полученные результаты представлены в таблице 1.

Таблица 1

Физико-химические и микробиологические показатели рыбных котлет

Вид рыбы	Белок (%)	Жир (%)	КМАФАнМ КОЕ/г
Вобла	9,85	2,78	$3x10^2$
Сазан	14,51	4,4	$1,3x10^2$
Лещ	14,91	5,35	$1x10^2$
Карась	12,94	3,30	$6x10^2$
Жерех	15,06	3,28	$3x10^2$

Анализ полученных данных показал, что массовая доля белка в образцах варьировала в пределах от 9,85 % до 15,06 %. Наименьшее содержание белка отмечено в котлетах из воблы (9,85 %), тогда как наибольшее — в образцах из жереха (15,06 %). Высокие значения белка также характерны для котлет из леща (14,91 %) и сазана (14,51 %). Котлеты из карася занимают промежуточное положение (12,94 %).

Содержание жира в исследуемых образцах находилось в диапазоне от 2,78 % до 5,35 %. Минимальная массовая доля жира установлена в котлетах из воблы (2,78 %), максимальная — в образцах из леща (5,35 %). Повышенное содержание жира также отмечено у котлет из сазана (4,4 %), тогда как образцы из карася (3,30 %) и жереха (3,28 %) характеризуются средними значениями данного показателя.

Микробиологические исследования показали, что уровень КМАФАнМ во всех образцах находился в пределах от $1x10^2$ до $6x10^2$ КОЕ/г. Наименьшее значение зафиксировано в котлетах из леща ($1x10^2$ КОЕ/г), наибольшее — в образцах из карася ($6x10^2$ КОЕ/г). Остальные образцы (вобла, сазан и жерех) характеризуются близкими значениями данного показателя — от $1,3x10^2$ до $3x10^2$ КОЕ/г. Микробиологические показатели всех образцов находятся значительно ниже допустимого уровня, установленного нормативной документацией ($2,5x10^3$ КОЕ/г), что свидетельствует о соблюдении санитарных требований при приготовлении котлет.[4]

Заключение

Проведённые исследования показали, что рыбные котлеты, изготовленные из малоценных видов рыб, характеризуются различной пищевой ценностью, обусловленной видом используемого сырья. Установлено, что наибольшее содержание белка наблюдается в образцах из жереха, леща и сазана, тогда как минимальные значения характерны для воблы; содержание жира варьирует в зависимости от биохимического состава исходной рыбы. Микробиологические показатели всех исследованных образцов находятся значительно ниже допустимого уровня, установленного нормативной документацией, что свидетельствует о соблюдении санитарных требований и правильности технологического процесса. Полученные результаты подтверждают, что использование малоценных видов рыб для производства фаршевых изделий является технологически обоснованным и перспективным направлением, позволяющим расширить сырьевую базу рыбной промышленности и обеспечить выпуск безопасной и питательной продукции.

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No 182 (182) (2026)

The scientific heritage
(Budapest, Hungary)
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Articles are accepted each month.
Frequency: 24 issues per year.
Format - A4
ISSN 9215 — 0365

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